REPORT

Draft
Corrective Action Plan
Building 1349 Study Area
Presidio of San Francisco, California

Presidio Trust
San Francisco, California
March 2005

THE PRESIDIO TRUST

Transmitted Via Hand Delivery

March 2, 2005

Mr. James Ponton
Regional Water Quality Control Board (RWQCB)
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, CA 94612

Re: Draft Corrective Action Plan Building 1349 Study Area, Presidio of San Francisco, California

Dear Mr. Ponton:

Enclosed please find one copy of the Draft Corrective Action Plan (CAP) Building 1349 Study Area Presidio of San Francisco, California prepared by Blasland, Bouck and Lee, Inc. for the Presidio Trust and dated March 2005. This Draft CAP was prepared in accordance with Task 6 of RWQCB Order R2-2003-0080. The Draft CAP also fulfills the California requirements of Title 23, California Code of Regulations (CCR), Division 3, Chapter 16, Article 11. This document was also submitted in compliance with its March 2, 2005 due date extension requested by the Trust.

If you should have any questions or comments regarding this matter, please feel free to contact me at (415) 561-4259 or Jennifer Yata at (415) 561-4272. The Trust looks forward to working with the RWQCB on this project.

Sincerely,

(BBL) for:

Craig Cooper
Remediation Program Manager
THE PRESIDIO TRUST

Enclosure: Draft Corrective Action Plan Building 1349 Study Area, Presidio of San Francisco, California

Cc with enclosure: Robert Boggs, Department of Toxic Substances Control
Brain Ullensvang, National Park Service
Doug Kern/Mark Youngkin, Restoration Advisory Board
Bruce Handel, USACE

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The Presidio Trust
San Francisco, California

March 2005

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engineers, scientists, economists

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List of Acronyms and Abbreviations

AHPA	Archeological and Historic Preservation Act
Army	U.S. Army
AST	aboveground storage tank
bgs	below ground surface
BAAQMD	Bay Area Air Quality Management District
BBL	Blasland, Bouck & Lee
BTEX	benzene, toluene, ethylbenzene, xylenes
CAP	Draft Corrective Action Plan for the Building 1349 Study Area
CCR	California Code of Regulations
CESA	California Endangered Species Act
Cl	Chloride
Cleanup Levels Document	*Development of Presidio-Wide Cleanup Levels for Soil, Sediment, Groundwater, and Surface Water*
COC	contaminants of concern
Cr	Chromium
DEH	Directorate of Engineering and Housing
DTSC	California Department of Toxic Substances Control
EKI	Erler & Kalinowski, Inc.
ESLs	Environmental Screening Levels
ESA	Endangered Species Acts
FDS	fuel distribution system
FPALDR	Fuel Product Action Level Development Report
GGNRA	Golden Gate National Recreational Area
GIS	geographical information system
GMPA	General Management Plan Amendment
gpm	gallons per minute
GSA	Federal General Services Agency
HCO_3	Bicarbonate
IT	International Technology Corporation
K	Potassium
K_H	Henry's Law Constant
K_{OC}	soil partition coefficient
LTTD	low temperature thermal desorption
LUCs	land-use controls
LUCMRR	Land Use Control Master Reference Report
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
meq/l	milliequivalents per liter
Mg	Magnesium
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
µg/L	micrograms per liter
MOA	Memorandum of Agreement
Na	Sodium

NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
Ni	Nickel
NPS	National Park Service
O&M	operation and maintenance
OCPs	organochlorine pesticides
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PG&E	Pacific Gas and Electric Co.
PLLW	Presidio Lower Low Water Datum of 1907
Presidio	Presidio of San Francisco
PTMP	Presidio Trust Management Plan
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RAB	Restoration Advisory Board
RAOs	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
RL	reporting limit
RUs	remedial units
RWQCB	California Regional Water Quality Control Board
SCRs	Site Cleanup Requirements
sf	square feet
SI	Site Investigation
Site	Study Area as defined on Figure 1-1 and Figure 1-2
SO_4	Sulfate
Study Area	Study Area as defined on Figure 1-1 and Figure 1-2
S_W	water solubility
SWRCB	California State Water Resources Control Board
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TDS	total dissolved solids
Title 27	Title 27 of the California Code of Regulations
TPH	total petroleum hydrocarbons
TPHg	total petroleum hydrocarbons as gasoline
TPHd	total petroleum hydrocarbons as diesel fuel
TPHd-unk	"unknown" fuel hydrocarbons
TPHd-e	total petroleum hydrocarbons-extractable
TPHfo	total petroleum hydrocarbons as fuel oil
Treadwell & Rollo	Treadwell & Rollo, Inc.
Trust	Presidio Trust
Trust Act	Section 103 of Omnibus Parks and Public Lands Management Act of 1996, Public Law 104-333, 110 State 4097
USACE	United States Army Corp of Engineers
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOCs	volatile organic compounds

VMP	Presidio Trust Vegetation Management Plan
Work Plan	*Draft Site Investigation Work Plan for the Building 1349 Study Area, Presidio of San Francisco*

1. Introduction

On behalf of the Presidio Trust (Trust), Blasland, Bouck & Lee (BBL) has prepared this *Draft Corrective Action Plan (Draft CAP) for the Building 1349 Study Area* at the Presidio of San Francisco (Presidio), San Francisco, California (the Study Area or Site, Figure 1-1). A Site Investigation (SI) was previously conducted to characterize the nature and extent of potential soil and groundwater impacts at the Study Area. The SI was performed in accordance with the *Draft Site Investigation Work Plan for the Building 1349 Area, Presidio of San Francisco, California* (Treadwell & Rollo, Inc. [Treadwell & Rollo], 2002). Results of the SI were presented in the *Draft Site Investigation Report for the Study Area, Presidio of San Francisco, California* (Treadwell & Rollo, 2003a). Additional SI activities and corrective actions were previously performed at the Study Area and are discussed further in Section 2 (Montgomery Watson, 1995a, 1996 and 1999; International Technology Corporation – [IT], 1996 and 1999).

As documented in the SI Report, the Study Area historically contained a petroleum hydrocarbon aboveground storage tank (AST). The Trust and the United States Army Corps of Engineers (USACE) investigated the Study Area in accordance with the California Regional Water Quality Control Board (RWQCB) orders and the California Department of Toxic Substances Control (DTSC) requirements to assess impacts to soil and groundwater associated with the storage, use, and release of petroleum-related chemicals related to the Building 1349 AST.

Using the information obtained during the various SI and corrective action activities, this Draft CAP was prepared to evaluate potential remedial alternatives to address adverse risks due to the release of petroleum-related chemicals and select corrective actions for implementation at the Study Area. The corrective actions selected under this CAP are intended to protect human health, safety, and the environment and protect current and potential beneficial uses of water, to the extent possible.

1.1 Presidio Background

The Presidio is located in the City of San Francisco, at the northern tip of the San Francisco peninsula (Figure 1-1). The Presidio occupies approximately 1,480 acres and is bounded by San Francisco Bay on the north and the Pacific Ocean on the west. Densely populated residential areas of San Francisco border the Presidio to the south and east.

The Presidio was a U.S. Army (Army) installation from 1848 through 1994, serving as a mobilization and embarkation point during several overseas conflicts, medical debarkation center, and coastal defense for the San Francisco bay area. Industrial operations formerly performed at the Presidio are associated with maintenance and repair of vehicles, aircraft, and base facilities. The Presidio also contains several landfills used by the Army to dispose of municipal waste and construction debris.

In December 1988, the Secretary of Defense's Commission on Base Realignment and Closure recommended closure of the Presidio. Under Public Law 92-589, the presidio was transferred to the National Park Service (NPS) on October 1, 1994 and became part of the Golden Gate National Recreational Area (GGNRA). As required by the Base Realignment and Closure Act, the Army initiated environmental studies in conjunction with the transfer of the property.

Section 103 of the Omnibus Parks and Public Lands Management Act of 1996, Public Law 104-333, 110 State 4097 (Trust Act) created the Trust. The Trust is a federal government corporation established to manage the

leasing, maintenance, rehabilitation, and improvement of the non-coastal portions of the Presidio (known as Area B). The Trust manages Area B in accordance with the general objectives of the General Management Plan Amendment (GMPA) (NPS, 1994), Section 1 of the GGNRA Act (Public law 92-589, 86 Stat. 1299, 16 USC 460bb), and the Presidio Trust Management Plan (PTMP) (Trust, 2002). The NPS retains responsibility for Area A (the coastal portions of the Presidio) in accordance with the GMPA. The Trust assumed responsibility for remediation of both Areas A and B of the Presidio on May 24, 1999 by signing the Presidio Memorandum of Agreement (MOA) and the Area A MOA. In addition, the Trust also entered into a Consent Agreement with DTSC and NPS on August 30, 1999 (DTSC, Trust, and NPS, 1999).

1.2 Study Area Background

The Study Area is located in the western portion of the Presidio, approximately 300 to 320 feet above the Presidio lower low water datum of 1907 (PLLW), and sits on a topographic high point on the boundary between the Marina Groundwater Basin and the Coastal Bluffs Groundwater Basin. The Study Area is delineated by Former Fill Site 5 and the western edge of Washington Boulevard to the west, Kobbe Avenue to the north, and Harrison Boulevard to the east (Figure 1-2). Former Fill Site 5 is located to the west of the Study Area and Former Landfill 4 is located to the east-southeast. The Study Area is located in the Presidio Forest planning area on the border of the Coastal Bluffs planning area in Area B of the Presidio and is subject to land uses identified in the PTMP (Trust, 2002). Current and planned land use at the Building 1349 Area is recreational, with special-status ecological species potentially present (Erler and Kalinowski, Inc - EKI, 2002).

The Building 1349 location was originally occupied by an AST that was built in 1906 in conjunction with the Presidio-Wide Fuel Distribution System (FDS). The AST was used to store fuel-heating oil that was distributed throughout the Presidio using the former FDS. The AST was approximately 100,000 gallons. The AST was replaced by Building 1349 in the early 1950s. Figure 1-2 identifies the location of the former AST and associated FDS piping. The FDS was decommissioned in sections beginning in the 1940s and ending in the early 1960s.

Building 1349 was a 100,000-gallon steel AST built in the 1950s (identified as Former Building 1349 Tank on Figure 1-2). The AST (Building 1349) was used to store fuel oil and then diesel fuel which was off-loaded to tanker trucks for transportation to various locations in the Presidio.

The USACE retained IT to perform the closure of Building 1349 in 1995. Closure activities occurred in October and November 1995 and included removing Building 1349 and its associated piping and excavating fuel-contaminated soil associated with former fueling operations at the Study Area. IT also conducted an FDS pipeline removal and abandonment project beginning in 1996 and removed the FDS pipelines within the Study Area (IT, 1999).

1.3 Regulatory Framework

As detailed in the RWQCB Order No. R2-2003-0080, Building 1349 is a known petroleum site requiring preparation and implementation of a CAP (RWQCB, 2003a). The RWQCB Order presents Site Cleanup Requirements (SCRs) for the protection of human health, ecological receptors, and water quality which were used to develop the CAP cleanup levels.

This Draft CAP was prepared in accordance with Task 6 of the RWQCB Order. The Draft CAP also fulfills the California requirements of Title 23, California Code of Regulations (CCR), Division 3, Chapter 16, Article 11.

Cleanup levels for the Study Area are specified in this Draft CAP. Petroleum contaminant cleanup levels are based on the SCRs listed in the RWQCB Order. Cleanup levels for non-petroleum contaminants are based on the planned land use and site lithology(ies), and are selected in accordance with the *Development of Presidio-Wide Cleanup Levels for Soil, Sediment, Groundwater, and Surface Water* (EKI, 2002) (Cleanup Levels Document). Applicable state and federal laws pertaining to this CAP are identified and presented in Section 5.7.

1.4 Public Participation

This Draft CAP will be subject to public review and comment, including the following:

- Consultation and coordination of corrective action alternatives and selection decisions with the regulatory agencies, NPS, and the Presidio Restoration Advisory Board (RAB).
- Preparation of response to comments received on the CAP. The response to comments for this CAP will be completed following receipt of stakeholder comments and will be included as Appendix A in the Final CAP.

2. Study Area Background

This section discusses the geology and hydrogeology, and previous investigations and corrective actions completed at the Study Area. This section also describes the source, nature, and extent of petroleum-related impacts encountered in previous investigations as well as recent quarterly groundwater monitoring results up to and including the second quarter 2004.

2.1 Study Area Geology and Hydrogeology

The following sections discuss the regional and site-specific geologic and hydrogeologic conditions in the vicinity of the Study Area.

2.1.1 Geologic Setting

The Study Area is located on a prominent hill that slopes gently to the east-northeast and steeply to the west-southwest towards Baker Beach and the Pacific Ocean (Figure 2-1). Ground surface elevations in the immediate area range from approximately 320 to 300 feet PLLW.

2.1.1.1 Regional Geology

The Presidio is located in the California Coastal Range Physiographic Provenance. The local geology consists of Franciscan Formation bedrock units, which are overlaid by various overburden deposits. The Franciscan Formation consists of a complex assemblage of sedimentary, volcanic, and metamorphic rocks ranging in age from the Late Jurassic to the Late Cretaceous. The assemblage is a result of accretionary forces as the Pacific Tectonic Plate was subducted under the North American Tectonic Plate. These accretionary forces ultimately led to the intense folding, faulting, and shearing of the resultant Franciscan Formation. In the San Francisco area, the Franciscan Formation consists primarily of sandstone, shale, siltstone, radiolarian chert, and mafic igneous rocks such as serpentinite (Schlocker, 1974). The Study Area lies in an active seismic zone located between two major north-west trending fault systems, the Hayward/Rogers Creek system and the San Andreas system.

At the Presidio, five bedrock units are recognized within the Franciscan Formation (EKI, 2002). These five units are:

- Serpentinite - Serpentinite is an ultramafic rock composed mostly of magnesium and iron minerals. Serpentinite intrusives and coherent blocks of hard rock in a matrix of intensely sheared shale and serpentinite comprise most of the outcrops or exposed bedrock observed in the Presidio (Schlocker, 1974). Serpentinite is a distinctive greenish-gray to bluish-gray rock that contains typically high concentrations of chromium, nickel, and cobalt (EKI, 2002).

- Sheared Rock - The Sheared Rock Unit is a mixed bedrock unit that consists of a soft, highly sheared clayey unit of serpentinite, shale/siltstone, or both, in which occur coherent blocks of Jurassic/ Cretaceous Sedimentary Rock and serpentinite.

- Jurassic/Cretaceous Sedimentary Rocks - Jurassic/Cretaceous Sedimentary Rock is a bedrock unit that is made up of interbedded sandstones, shales, and occasional conglomerates.

- Greenstone - Greenstone is a bedrock unit made up of dark green meta-basalt that occurs interbedded with the Jurassic/Cretaceous Sedimentary Rocks and the Chert/Shale.

- Chert/Shale - Chert/Shale is a bedrock unit made up of alternating beds of hard, red-brown chert and softer, red-brown shale. It occurs interbedded with greenstone and Jurassic/Cretaceous Sedimentary Rocks. At the Presidio, both Greenstone and Chert/Shale are exposed in minor outcrops only along the Coastal Bluffs.

Three main soil types are recognized at the Presidio. These include serpentinite soil, Colma Formation, and beach dune sand (EKI, 2002). The Colma Formation and beach dune sand are both unconsolidated sediments deposited on top of bedrock. Serpentinite soils are derived from serpentinite bedrock. As described above, serpentinite is a distinctive greenish-gray to bluish-gray rock that tends to weather to poorly formed soils in a wide range of grain sizes. The Colma Formation is Pleistocene in age and consists of fine- to medium-grained sand with moderate amounts of silt and clay that was deposited in esturine and coastal environments. Beach dune sand is characterized at the Presidio as highly permeable, clean, well-sorted sand that is yellowish brown to light gray in color.

Several secondary soil types are also recognized at the Presidio, including Quaternery slope debris and ravine fill. Slope debris and ravine fill is described as highly variable combinations and percentages of silts, clays, sands, and gravels. The slope debris and ravine fill is generally associated with landslide deposits and soil derived from any of the three main soil types recognized in the Presidio (Colma Formation, beach dune sand, and serpentinite) (EKI, 2002).

2.1.1.2 Study Area Geology

Figure 2-2 presents a conceptual stratigraphic cross-section across the Study Area. Soil borings at the Study Area indicate that unconsolidated overburden deposits range from approximately 10 to 40 feet thick. These unconsolidated overburden deposits overlie Franciscan Formation bedrock.

Overburden

Soil beneath the Study Area generally consists of Quaternary slope debris and ravine fill. While quaternary beach dune sand deposits have been mapped as occurring at the eastern edge of the Study Area (EKI, 2002 and Schlocker, 1974), it is noted that the mapped contacts have not been field verified (EKI, 2002). A review of boring logs from previous SIs (Montgomery Watson, 1995a and 1996 and Treadwell & Rollo, 2003a) indicates that beach dune sand is not present in the Study Area. These boring logs indicate that overburden soils throughout the Study Area consist of relatively low permeability silty sand and silty clay. The description of these deposits is consistent with slope debris and ravine fill, not the highly permeable, clean, and well sorted beach dune sand. The overburden deposits in the Study Area also have frequently been noted to contain weathered fragments of local bedrock. The local bedrock is described below.

As noted above, beach dune sand is not found in the Study Area and the Colma Formation is not mapped in the vicinity of the Study Area and not expected to occur in highland regions of the Presidio such as the Study Area. The slope debris and ravine fill found at the Study Area appear to be derived from serpentinite soils and the underlying Franciscan Formation. The slope debris and ravine fill deposits at the Study Area are expected to

contain materials with geochemical characteristics of the serpentinite soil types as well as the shales, siltstones, sandstones, and serpentinite.

Bedrock

The slope debris and ravine fill unit overlie Franciscan Formation bedrock (Figure 2-2). The Franciscan Formation has been observed in the Study Area and is interpreted to be approximately 10 to 40 feet below ground surface (bgs). Based on drilling conditions and boring logs, it appears that the upper 45 feet of the Franciscan Formation is highly weathered, fractured bedrock with interbedded zones consisting of weathered clay and silt. The Franciscan Formation in the Study Area consists primarily of serpentinite, Sheared Rock, and Jurassic/Cretaceous Sedimentary Rock units described in Section 2.1.1.1.

In June 1994, Resolution Resources, Inc. conducted a high-resolution seismic reflection survey at the Study Area to further assess the depth to the bedrock surface and determine whether seismic faults are present. The results of the survey indicated that many fault and fracture zones bisect the Study Area (Montgomery Watson, 1996).

Based on a review of boring logs in the vicinity of the Study Area, up to three apparent faults were identified (Figure 2-2). The faults appear to displace two distinct blocks of the Franciscan Formation consisting mainly of serpentinite relatively upward from two blocks of Franciscan Formation consisting of mainly siltstone and shale. The southeastern-most interpreted fault is believed to trend approximately northeast to southwest. It is likely that other interpreted faults may parallel this fault trend orientation.

2.1.2 Hydrogeology

2.1.2.1 Groundwater Monitoring Well Network Description

The Study Area is located on a topographic high point and local groundwater recharge zone at the boundary of the Marina Groundwater Basin and the Coastal Bluffs Groundwater Basin. A total of nine monitoring wells are associated with the Study Area. Five additional monitoring wells are located to the west-southwest of the Building 1349 Study area in adjacent Former Fill Site 5. The fourteen monitoring wells are used to evaluate hydraulic conditions at the Study Area. It should be noted that former monitoring well 1349MW03 was located in Former Fill Site 5, but was abandoned in 2002 to accommodate remedial excavation activities in that area. Current well, 1349MW03R, was installed near the former well 1349MW03 location to serve as a replacement.

The Study Area monitoring wells are constructed with their well screen intervals within the Franciscan Formation. Well screens are between 10 and 17 feet long with the top of screen elevations ranging between approximately 272 to 285 feet PLLW. The top of the well screens are located between 5 and 28 feet below the top of bedrock. The screened intervals for Study Area monitoring wells generally intersect the apparent static water level at each location.

2.1.2.2 Groundwater Occurrence and Flow

Apparent static groundwater elevations (groundwater elevations) occur at approximately 280 to 272 feet PLLW at Study Area monitoring wells. Groundwater elevations decrease to the southwest of the Study Area to approximately 220 feet PLLW in the adjacent Former Fill Site 5 area (Table 2-1 and Figure 2-3). Average depth to groundwater ranges between 26 feet bgs at well 1349MW102 and 39 feet bgs at well 1349MW103. Seasonal

groundwater seeps are reported to occur more than 500 feet to the south-southwest of the Study Area, at the western edge of Former Fill Site 5.

Groundwater at the Study Area occurs primarily within the Franciscan Formation. As noted previously, the Franciscan Formation is highly deformed and fractured. Groundwater flow occurs within secondary porosity created by the fracture networks and the relative permeability is expected to be variable, but generally low based on the amount of secondary mineralization in individual fractures. It has been noted in individual boring logs that some apparent fractures were remineralized or in-filled with clays. Groundwater monitoring well purge records were evaluated to estimate the hydraulic conductivity of the water bearing zone in the Study Area. Hydraulic conductivities were found to vary, ranging between $1x10^{-4}$ to $1.6x10^{-3}$ cm/sec. The specific yields of Study Area monitoring wells also vary. Purge records indicate that sustained pumping at rates as low as 0.2 gallons per minute (gpm) cannot be sustained without dewatering wells in a relatively short period of time (less than one hour). As such, the influence of anisotropy should be considered when evaluating hydraulic conditions at the Study Area. The combination of low permeability, relatively low hydraulic gradients, and anisotropy combine to make interpretation of local groundwater flow direction proximate to the Marina and Coastal Bluffs groundwater basin divide challenging.

Figure 2-3 depicts the groundwater elevations at the Study Area and the adjacent Former Fill Site 5 area. Analysis of the potentiometric data indicates that a relatively steep hydraulic gradient exists to the southwest of the Study Area near Former Fill Site 5. Based on potentiometric data in that area, the apparent groundwater flow direction is to the southwest from monitoring well 1349MW102 towards well LF5GW100. However, the potentiometric surface beneath most of the Study Area is indicative of a recharge area and is relatively flat with a general radial flow pattern. Within this area, groundwater elevation data indicate two localized potentiometric highs both to the southwest and northeast of Washington Boulevard and separated by a slight potentiometric low in the vicinity of well 1349MW100. The highest potentiometric elevation is found at well 1349MW102. The relative potentiometric highs and lows observed on Figure 2-3 are consistent with historic groundwater elevation data seen in Table 2-1. Furthermore, the high groundwater elevation at well 1349MW102 is noted to be in close proximity to the groundwater basin boundary depicted in Figure 2-3, taken from the Cleanup Levels Document (EKI, 2002). It should also be noted, that subtle variations in apparent groundwater elevations are likely influenced by the shape of the bedrock surface and the orientation of known fault zones. These features may also influence the apparent groundwater flow direction, especially towards the west of wells 1349MW100 and 1349MW102.

Geochemistry

Hydrogeochemical conditions at the Study Area were evaluated based on groundwater samples collected from monitoring wells within the Study Area (see Table B-5 and B-11) and adjacent Former Fill Site 5 (data evaluated from Treadwell & Rollo, 2004 – Appendix A-9). Groundwater in most wells in the Study Area exhibits characteristics typical of a groundwater recharge area with moderately oxic conditions and circum neutral pH, based on average concentrations of dissolved oxygen content and pH. However some variability in hydrogeochemistry is observed across the Study Area. This variability is attributed to both anthropogenic factors (presence of petroleum hydrocarbons in the groundwater system) and natural factors (differing geochemistry of rock or overburden materials and differing groundwater flow regimes). Some examples of this variability are discussed below.

- The pH of some wells screened in serpentinite, particularly wells 1349MW03R, 1349MW103, and 1349MW105, are slightly more alkaline with observed average pH of up to 7.8. This is within the range of pH values observed in other Presidio upland wells screened within serpentinite or in areas where groundwater is influenced by serpentinite (Montgomery Watson, 1998).

- The hydrogeochemistry of some wells exhibit evidence of anoxic, or reducing, conditions based on the levels of dissolved oxygen, dissolved iron, and sulfate. For example, reducing conditions are observed in well 1349MW100 as noted by its relatively low dissolved oxygen content, elevated dissolved iron, and low sulfate concentrations. As discussed in Section 2.4.6, well 1349MW100 is impacted by petroleum hydrocarbons. Bacteria involved in the natural degradation of petroleum hydrocarbons in groundwater typically consume available oxygen, resulting in localized reducing conditions.

An evaluation of spatial trends in hydrogeochemistry can provide further insight into understanding groundwater flow in complex anistropic systems such as the system present at the Study Area. To further evaluate the hydrogeochemistry of the Study Area, the relative abundance of typical anion and cation pairs as well as total dissolved solids (TDS) concentrations, based on data presented in Table B-5 and Table B-11 and Appendix A-9 (for Former Fill Site 5 wells) of the Semiannual Groundwater Monitoring Report (Treadwell & Rollo, 2004), were evaluated. Two methods for evaluating hydrogeochemistry were used, which involve plotting the concentration in milliequivalents per liter (meq/l) or relative abundance of anions and cations on Piper plots and Stiff diagrams, respectively. A summary of this observed geochemical variability is shown on Stiff diagrams on Figure 2-3A and Piper plots on Figures G-1 and G-2 in Appendix G. The groundwater data presented in these figures are from the March 2004 groundwater sampling event.

In general, the data suggest that two distinct groundwater types exist at the Study Area based on geochemical signatures. Wells located generally to the west of the inferred groundwater divide, including wells 1349MW101 and LF5GW100 through LF5GW104, tend to have modest TDS and can be classified as magnesium (Mg)/sodium (Na)-chloride (Cl)/bicarbonate (HCO_3) type water. Wells generally to the east of the groundwater divide (1349MW103, 1349MW104 and 1349MW105), or immediately to the west of the divide (1349MW01), have relatively high TDS and can be characterized as Mg-Cl type water. Other wells, including 1349MW02 and 1349MW102, generally have geochemical signatures that indicate a mixture of the two described groundwater types. Well 1349MW100, as depicted on these figures, has a geochemical signature that is similar to Mg/Na-Cl/HCO_3 water, but exhibits a relatively high TDS content. It should be noted that during other monitoring periods, the relative Na contribution is less and the relative Cl contribution is higher in 1349MW100, thus producing a signature indicating a mixture between the two main types of waters described.

Well 1349MW100 also has a relatively high HCO_3 contribution in relation to the other wells, in addition to virtually no sulfate contribution. Because the degradation of petroleum hydrocarbons can often lead to enriched HCO_3 and depleted sulfate, this observation suggests that the groundwater in this area has been affected by natural degradation of petroleum hydrocarbons. Groundwater at well 1349MW03R has a geochemical signature that is unique from the other wells. The difference is due to a lower relative contribution of Cl at this location. With the exception of the relatively low Cl concentration at this location, the geochemical signature would be very similar to the Mg/Na-Cl/ HCO_3 waters seen in this area.

Waters dominated by Mg and Cl are not common; however, these types of waters could be locally characteristic of rocks containing serpentinite, which is Mg-rich and could also contain a significant fraction of dissolvable Cl as indicated by Sharp and Barnes (2004). Previous hydrogeochemical studies at Presidio uplands areas associated with serpentinite indicate that groundwater has a strong Mg component that is associated with the serpentinite (Montgomery Watson, 1998). The wells that exhibit a Mg-Cl signature are screened within fractured serpentinite and are located within the area with a generally flat potentiometric surface as indicated in Figure 2-3. Wells exhibiting a mixed geochemical signature are screened either in serpentinite or shales/ siltstones of the Sheared Rock or Jurassic/Cretaceous Rock units, but are also within the area of the relatively flat potentiometric surface. This would suggest that a mixing zone may exist near the apparent groundwater divide.

Previous hydrogeochemical studies at Presidio uplands areas associated with serpentinite indicate that groundwater has a strong Mg component that is associated with the serpentinite (Montgomery Watson, 1998). The wells that exhibit a Mg-Cl signature are screened within fractured serpentinite and are located within the area with a generally flat potentiometric surface, as indicated in Figure 2-3. Wells exhibiting a mixed geochemical signature are screened either in serpentinite or shales/ siltstones of the Sheared Rock or Jurassic/Cretaceous Rock units, but are also within the area of the relatively flat potentiometric surface. This would suggest that a mixing zone may exist near the apparent groundwater divide.

2.1.2.3 Summary of Hydrogeologic Conditions

Based on the evaluation of groundwater elevation data and geochemical data, it is apparent that groundwater flow in the Study Area is anisotropic, influenced by the fracture flow network and bedrock geometry. A general radial flow pattern exists in the vicinity of the groundwater divide and recharge area. Two groundwater types are observed in the Study Area with a mixing zone that is roughly coincident with the apparent groundwater divide, which is located to the east of Washington Boulevard. The direction of groundwater flow becomes more consistent and better defined with distance away from the groundwater divide, with flow to the east (the Marina Groundwater Basin) and to the west (the Coastal Bluffs Groundwater Basin). This is especially evident towards the west in the general area of Former Fill Site 5 where a steeper hydraulic gradient is observed and a greater number of downgradient wells exist to effectively interpret apparent groundwater flow direction.

2.2 Source Areas

This section presents a summary of the potential sources of contaminant releases at the Study Area, including operational histories. Based on a review of the known Site history (Section 1.2), the following contaminant source areas have been identified for the Study Area:

- ***Former fuel oil AST***: Former Building 1349 contained a 100,000-gallon fuel oil AST which was constructed in 1906 in association with the FDS. Fuel oil was stored in the AST and distributed throughout the Presidio via the FDS.

- ***Former diesel oil AST (i.e., Former Building 1349)***: The fuel oil AST was replaced in the 1950s by a 100,000-gallon steel AST. The replacement AST was initially used for fuel oil storage and then was converted to diesel fuel storage. A fuel dispensing structure was reportedly installed along Washington Boulevard for dispensing the diesel from the tank to fuel trucks which would then transport the diesel to various locations throughout the Presidio. An underground pipe connected the AST to the fuel dispensing structure.

- ***Former FDS piping***: The FDS, a network of pipelines built in the early 1900s, distributed fuel oil throughout the Presidio. The FDS ceased operations and was decommissioned in sections beginning in the 1940s and ending in the early 1960s.

2.3 Special Study Area Feature (Telecommunications Conduit)

A telecommunications conduit is located on the eastern side of Washington Boulevard (Figure 2-4). This conduit contains a fiber-optic telecommunications cable owned by the Trust. The conduit is approximately 2- to

2.5-feet wide and 2.5-feet deep. The top of the conduit occurs at approximately 1-foot below grade. It is important that any corrective actions do not unduly threaten or damage the integrity of this line. Appropriate measures would need to be implemented to carefully protect or re-route this line to allow potential corrective actions to be conducted. This is further discussed in Section 4.0.

2.4 Previous Investigations and Corrective Actions

This section discusses the results of previous investigations and corrective actions conducted for the Study Area. Two previous corrective actions by the Army have occurred at the Study Area involving (1) the demolition and removal of Building 1349 and its associated piping and (2) the removal of the former FDS at the Study Area. There is no information regarding the removal of the former AST which was replaced by the Building 1349 AST in the early 1950s. It should be noted that these past corrective actions have effectively addressed the majority of petroleum-related impacts in the Study Area. This Draft CAP proposes corrective actions for the remaining petroleum-related impacts, some of which are located in areas where corrective actions have proven to be difficult due to sensitive Study Area infrastructure and geologic conditions, as discussed below.

The chemical analytical results described below are discussed in the context of action levels and/or screening levels that were used at the time of each investigation or corrective action, where available. These action levels and/or screening levels for petroleum hydrocarbons are equivalent to the SCRs adopted by the RWQCB in Order No. R2-2003-0080 (RWQCB, 2003a) for the Presidio and are the cleanup levels selected for this CAP (Section 3.2). Figures 2-4 through 2-7, which are referred to below, present the chemical results exceeding CAP cleanup levels. Tables in Appendices B and C provide the analytical data from the previous investigations and corrective actions.

2.4.1 1995-1996 Site Investigation

The USACE retained Montgomery Watson to conduct an SI in three phases to determine the vertical and lateral extent of soil and groundwater contamination (Montgomery Watson, 1995a, 1996). The SI was initially conducted in response to a visual observance of stained soil downgradient from Building 1349. For discussion purposes, the results of the 1995-1996 SI are discussed relative to CAP cleanup levels (Section 3.2), as no screening levels were used in the SI.

Phases 1 and 2 (Montgomery Watson, 1995a)

During Phase 1 in August 1993, the Army advanced 14 soil borings (1349SB01 through -13; 1349DB01) to depths ranging from 4.5 to 45 feet bgs (Figure 2-4). One grab groundwater sample and 51 soil samples were collected and analyzed for total petroleum hydrocarbons (TPH) as diesel (TPHd); benzene, toluene, ethylbenzene, and xylenes (BTEX); and metals.

In February 1994, Phase 2 of the SI was conducted to better define the extent of hydrocarbon contamination in the area of the drainage gully between the Building 1349 concrete pad and Washington Boulevard. Eight additional soil borings (1349SB14 through -21) were installed to depths ranging from 15 to 40 feet bgs (Figure 2-4). A total of 37 soil samples and one grab groundwater sample were collected during the Phase 2 SI and analyzed for TPHd and BTEX. Immunoassay screening tests for TPHd were also conducted at six locations to assist in locating shallow soil borings.

Results of the Phase 1 and 2 sampling indicated elevated TPH soil concentrations above cleanup levels in the area of the gully, between the Building 1349 concrete pad and Washington Boulevard. TPHd-extractable (TPHd-e; representing hydrocarbon patterns resembling diesel fuel or fuel oil) was detected at a maximum concentration of 170,000 milligrams per kilogram (mg/kg) at 1 foot bgs in this area (Appendix C) which exceeds the TPHd ecological cleanup level of 700 mg/kg. The source of this contamination was believed to be either a surface spill of diesel and/or fuel oil near the gully or an underground pipeline leak between the fuel dispensing structure and the AST. Toluene, ethylbenzene, and xylenes were detected below cleanup levels at maximum concentrations of 1.1, 2.6, and 20 mg/kg in the area of TPH contamination (Appendix C).

Metals detected at concentrations exceeding serpentinite background values for the Presidio (EKI, 2002) were arsenic, beryllium, copper, lead, mercury, vanadium, and zinc (Appendix C). Metals detected in soil above serpentinite background and cleanup levels were arsenic and vanadium. A statistical evaluation of metals, including an analysis of their occurrence with TPH, ethylbenzene, and xylenes, was conducted in the 1995 SI Report (Montgomery Watson, 1995a). The evaluation demonstrated that the distributions of TPH, ethlylbenzene, and xylenes, which were associated with large standard deviations and skewness coefficients, were consistent with the existence of a fuel contamination at the site. In contrast, the distributions of metals were much smaller and fairly consistent. Average concentrations of all analytes (metals, TPH, ethylbenzene, and xylenes), corresponding to each quartile of the TPH levels, were then calculated. The average quartile concentrations of ethylbenzene and xylenes showed a strong relationship to the TPH levels. This is expected as they are constituents of diesel and fuel oil, which are measured as TPH. In contrast, the average metal levels of the samples corresponding to each of the four TPH quartiles were statistically equivalent. Based on this evaluation, Montgomery Watson concluded that metal levels in soil at the Study Area are unrelated to the TPH levels in the area, and with the exception of one lead result of 126 mg/kg (1349SB09 at 0.5 foot bgs), were assumed to be naturally occurring. The lead result is below the ecological special-status cleanup level of 160 mg/kg.

The two grab groundwater samples were collected from borings1349SB09 and -19, both on the west side of Washington Boulevard, downslope of the drainage gully. TPHd was detected at 110,000 micrograms per liter (µg/L), above the cleanup level of 880 µg/L, in boring 1349SB19. Xylenes were detected below the cleanup level in the same boring. TPHd-e was detected at 110 µg/L in boring 1349SB09 (Appendix C tables). Low concentrations of total metals (chromium, copper, iron, manganese, nickel, vanadium, and zinc) were also detected in groundwater.

Physical and biological tests were also conducted on a few soil samples to assess the viability of various remediation technologies for soil at the Study Area, such as bioventing, in-situ bioremediation, and soil vapor extraction (SVE). The results of these analyses indicated that there is an availability of indigenous microorganisms, adequate supplies of nitrogen and phosphorous, and absence of environmental toxins to those microorganisms. These results are further discussed in the context of possible corrective actions in Section 4.5.4.

Phase 3 (Montgomery Watson, 1996)

In July and August 1995, the Army conducted an Additional SI (Phase 3). The objectives of the Additional SI were to: (1) further assess the extent of saturated zone contamination; (2) better define site geology; (3) collect soil and groundwater samples; and (4) install groundwater monitoring wells to monitor the site hydrogeology and water chemistry. Nine soil borings (1349SB22 through -30) were drilled to depths ranging from 38 to 58 feet bgs (Figure 2-4). A total of 68 soil samples were collected from 5 to 58 feet bgs and analyzed for TPHd-e. TPHd-e was detected at all sample locations, with a maximum concentration of 990 mg/kg at 1349SB25 at 40 feet bgs, which was below the water table at approximately 36 feet bgs. Concentrations of TPHd-e in this

boring were 7.7 mg/kg and less from the surface to 30 feet bgs (Appendix C tables). A pattern of relatively low TPHd-e concentrations in shallower samples, but elevated TPHd-e concentrations at depth, was also noted in borings 1349SB23, -26, and -28. However, all concentrations of TPHd-e in samples collected above the water table were below the cleanup levels.

Two surface soil samples (1349SS01 and -02) were also collected in the area of visually stained soil and analyzed for polycyclic aromatic hydrocarbons (PAHs). Only pyrene was detected at 3 mg/kg in sample 1349SS02, below the cleanup level (Appendix C).

One grab groundwater sample was also collected from each of the nine borings and analyzed for TPHd-e and BTEX. TPHd-e was detected in groundwater at borings 1349SB22, -25, and -27 (west and south of former Building 1349), with a maximum concentration of 24,000 µg/L at 1349SB25, exceeding the cleanup level of 880 µg/L (Appendix C tables). Soil samples from this boring also had the highest concentrations of TPHd-e of the samples collected during Phase 3.

Based on the results of the grab groundwater samples, three borings (1349SB26, -28, and -30) were converted to monitoring wells (1349MW01 through -03) and sampled in August 1995. The groundwater samples were analyzed for TPHd-e and BTEX. No chemicals were detected in these samples (Appendix C tables).

2.4.2 Building 1349 AST Removal

In October and November 1995, the USACE implemented a removal action involving the demolition and removal of Building 1349 (100,000-gallon AST) and its associated piping and excavation of fuel-contaminated soil associated with former fueling operations at the Site (IT, 1996). The tank was prepared for demolition by triple-rinsing it using a high-pressure hydroblaster. The tank was then inspected for structural integrity and determined to be in sound condition, with no holes or failures.

Following the demolition and removal of the Building 1349 AST and associated piping, soil excavation activities occurred in three areas, labeled as Areas 1, 2, and 3 on Figure 2-4. The Area 1 excavation was approximately 35 by 25 feet and extended to an approximate depth of 7 feet bgs. Excavation Areas 2 and 3 were located on either side of the telecommunications conduit located parallel to Washington Boulevard, in the vicinity of the TPH contamination identified in the SI (Montgomery Watson, 1995a, 1996). The Area 2 excavation was approximately 70 by 25 feet and extended to a maximum depth of approximately 12 feet bgs. The Area 3 excavation was approximately 40 by 50 feet and extended to a depth of approximately 13.2 feet bgs. All three areas were backfilled with approximately 700 yards of controlled density fill. Excavation Areas 1 and 2 were backfilled with controlled density fill to a minimum of 6 feet below grade and Area 3 was backfilled to within 1 foot of grade to facilitate the repaving of Washington Boulevard (IT, 1996). In addition, approximately 300 yards of pre-approved clean sand fill was backfilled on top of the controlled density fill at Areas 1 and 2 (IT, 1996).

Post-excavation samples were collected to characterize the limits of the excavations. Action levels used during the process were from the Fuel Product Action Level Development Report (FPALDR; Montgomery Watson, 1995b); it is noted that these action levels are equivalent to the SCRs adopted by the RWQCB in Order No. R2-2003-0080 (RWQCB, 2003a) for the Presidio and are the cleanup levels selected for this CAP. Immunoassay tests were initially used to indicate whether TPHd concentrations were below the action levels. Post-excavation confirmation soil samples were then collected at each of the three areas and analyzed for TPHd, BTEX, and PAHs by a certified laboratory. Post-excavation confirmation data indicated the removal of all soils containing chemical concentrations in excess of the action levels with the exception of soils located directly underneath the

telecommunications conduit (Figure 2-6). Soil excavation could not continue in this area without compromising the integrity of the telecommunications conduit. Soil overlaying the conduit was removed during this remedial action. The dimensions of the soil column beneath the conduit across Areas 2 and 3 measured approximately 75 feet long by 6 feet wide and 12 feet bgs.

Soil sample results for the soil left in-place beneath the conduit are provided in Tables B-3 and B-4. Based on the results of nine post-excavation confirmation soil samples, concentrations of TPHd in soil left in-place under or immediately adjacent to the conduit ranged from 14,000 to 24,000 mg/kg in the 3 foot bgs interval; 13,000 to 14,000 mg/kg in the 4 to 6 foot bgs interval; and 3,200 to 10,000 mg/kg in the 12 foot bgs interval (Table B-1). Elevated concentrations of PAHs were also detected in soil under the telecommunications conduit. Concentrations for naphthalene and benzo(a)pyrene ranged up to 51 and 89 mg/kg, respectively. In addition, several PAHs, including benzo(a)anthracene, benzo(a)pyrene, benzo(b)flouranthene, benzo(k)flourathene, and chrysene, were reported as non-detect in laboratory data; however, the analytical reporting limits (RLs) for these PAHs were several times greater than their corresponding cleanup levels for the area. BTEX were not detected above their respective action levels in the post-excavation confirmation samples.

2.4.3 FDS Removals

In 1996 and 1997, the USACE retained IT to remove all Presidio-wide piping associated with the former FDS (IT, 1999). The FDS removal actions included the: (1) removal of FDS piping or abandonment in place of FDS piping located in inaccessible and/or sensitive areas; (2) assessment of soil in FDS removal sections via field and laboratory analysis of soil samples; (3) excavation of petroleum hydrocarbon-affected soils and recycling and/or disposal of soils; and (4) restoration of each FDS removal section, including backfilling, paving, planting, and/or reseeding. IT divided the FDS removal action into 50 locations, each with its own trench and pipeline description, summary of excavations, and site-specific soil action levels. The soil action levels were the SCRs obtained from RWQCB Order No. 96-070 (RWQCB, 1996); it is noted that these action levels are equivalent to the SCRs adopted by the RWQCB in Order No. R2-2003-0080 (RWQCB, 2003a) for the Presidio and are the cleanup levels selected for this CAP.

Two FDS pipeline removal actions, MT-6 and MT-7, occurred in the vicinity of Building 1349 (IT, 1999). At these areas, soils were excavated beyond the pipe trench to meet the applicable soil action levels. The MT-6 section of piping within the Study Area boundaries originated at Building 1349 and trended northeast to Kobbe Avenue (Figure 2-4a). Approximately 550 linear feet of 6-inch pipeline were excavated and removed from section MT-6 within the Study Area. All piping which was located within the Study Area in section MT-6 was removed. Two nearly parallel trenches, approximately 250 to 300 feet long by 2 feet wide and 3 to 6 feet deep, were excavated within the Study Area (Figure 2-4a).

The MT-7 section of piping within the Study Area boundaries originated at Building 1349 and trended generally east to Harrison Boulevard (Figure 2-4a). Approximately 500 linear feet of pipeline were excavated and removed from section MT-7 within the Study Area. All piping which was located within the Study Area in section MT-7 was removed. The MT-7 removal consisted primarily of three trenches within the Study Area (Figure 2-4a). The two northern trenches were approximately 175 feet long by 2.75 wide, and the southern trench was approximately 75 feet long by 2.75 feet wide. Minor trenches to the former AST were also excavated. The excavation depths varied from 1.5 to 6 feet bgs.

Immunoassay test results for samples collected along the MT-6 and MT-7 trench excavations indicated that all TPH and PAH concentrations were below action levels, except in three areas which were over-excavated (i.e., FDS Remedial Excavations South, Middle, and North). These three excavations were completed in the area

north of Building 1349, where the two parallel FDS pipelines in section MT-6 (trending north/south) met the east/west trending pipeline associated with section MT-7 (Figure 2-4a). The total volume of soils excavated from the three FDS Remedial Excavations was approximately 190 cubic yards. Post-excavation confirmation soil samples were collected from the bottoms and sidewalls of the FDS excavations and analyzed for TPH and PAHs by immunoassay analysis. Ten percent of the samples were also analyzed at an off-site laboratory for TPHd, TPH as fuel oil (TPHfo), and PAHs. Immunoassay and laboratory analytical results for confirmation samples indicated that soils exceeding the action levels were left in-place at the following FDS Remedial Excavations (Figure 2-4a and Appendix C tables):

- FDS North: TPH was measured at >1,380 mg/kg and PAHs at >5.0 in four samples; laboratory results for sample FM06043W04 confirmed TPHd at 1,400 mg/kg, TPHfo at 1,800 mg/kg, and benzo(a)pyrene at 0.36 mg/kg;

- FDS Middle: TPH was measured at >1,380 mg/kg and PAHs at >5.0 in two samples; laboratory results for sample FM07044W09 confirmed TPHd at 1,300 mg/kg, TPHfo at 1,800 mg/kg, and benzo(a)pyrene at 0.30 mg/kg; and

- FDS South: TPH was measured at >6,856 mg/kg and PAHs at >5.0 mg/kg in two samples and TPH was measured at >1,380 mg/kg in one confirmation sample.

The northern portions of the MT-6 trench excavations and eastern portions of the MT-7 trench excavations were backfilled with overburden soil from the excavations to 18 inches bgs and with imported topsoil to the ground surface. Prior to using the overburdened soil as backfill, field immunoassay and/or laboratory analyses were performed on the overburden soil to ensure the soil concentrations were below the discharge criteria of 100 mg/kg for TPH, 5.6 mg/kg for PAHs, and no detectable levels of BTEX (IT, 1999; RWQCB, 1996). Laboratory analysis of backfill soils used in the MT-6 trench excavation area suggests that the overburden soils contained TPHfo at 250 mg/kg (with a duplicate result of <540 mg/kg), which exceeded the discharge requirement of 100 mg/kg. However, this concentration did not exceed the human health and ecological action levels (i.e., SCRs from RWQCB Order No. 96-070).

According to the FDS Removal Report (IT, 1999), excavations of the FDS trenches and FDS Remedial Excavations in the vicinity of the former AST (i.e., the southern portions of the MT-6 trench excavations, western portions of the MT-7 trench excavations, and the three FDS Remedial Excavations) were backfilled with low temperature thermal desorption (LTTD)-treated soils to 2 feet bgs and imported top soil to the ground surface. The approximate areas with potential LTTD soil backfill are shown on Figure 2-4a. Analytical results for LTTD treated soils that were used as backfill confirmed that TPH, BTEX, and PAHs were below the action levels or SCRs from RWQCB Order No. 96-070 (IT, 1999; EKI, 2004).

2.4.4 Additional Investigation of FDS

The USACE retained Montgomery Watson to assess the presence of suspected FDS pipeline segments and evaluate whether releases of petroleum fuels occurred along the previously removed pipeline segments (Montgomery Watson, 1999). For the Study Area, the objective of the investigation was to evaluate whether fuel was released from the former FDS pipeline at concentrations above the RWQCB Order 96-070 SCRs for petroleum-impacted soils. The former FDS pipeline evaluated during the investigation trended south from the tank across Washington Boulevard., approximately parallel to Lincoln Blvd., and through Former Fill Site 5 to Building 1773 (Figure 2-4a).

Three borings, FDSSB227 through -229, were drilled at approximate 100-foot intervals along the former FDS pipeline (Figure 2-4A). Soil samples were collected at approximately 3 feet bgs and 6 to 8 feet bgs. The soil samples collected at 3 feet bgs were analyzed by immunoassay techniques. TPHfo was not detected at a concentration equal to or greater than the SCR of 115 mg/kg in the three samples. Montgomery Watson, therefore, concluded that a decision document should be prepared recommending no further action for this portion of the FDS.

2.4.5 2002-2003 Site Investigation

The Trust retained Treadwell & Rollo to conduct an SI to characterize the nature and extent of contamination at the Study Area and collect data required to evaluate potential remedial alternatives for the Study Area (Treadwell & Rollo, 2003a). The SI was conducted in two phases. Phase 1 was conducted in September 2002 to identify the presence of contamination in suspected source areas. The purpose of Phase 2, conducted in April and May 2003, was to delineate the nature and lateral and vertical extent of contamination found during Phase 1.

During Phase 1, a total of 21 soil borings (1349SB100 through -120) were advanced to depths ranging between 3 and 46.5 feet bgs (Figure 2-4). One boring (1349SB106) was later converted into a monitoring well (1349MW100). In preparation for the Fill Site 5 remedial action, which began in January 2003, monitoring well 1349MW03 was abandoned. During Phase 2, a total of 18 soil borings (1349SB121 through -134; 1349MW102, -104, -105, and 03R) were advanced to depths ranging between 6 and 48 feet bgs (Figure 2-4). Six of the borings were later converted into monitoring wells (1349MW101 through -105, and -03R).

A total of 85 soil samples were collected during Phases 1 and 2 of the SI. The soil samples were analyzed for TPHd, TPHfo, and/or PAHs. A total of 11 grab groundwater samples were collected and analyzed for TPHd and TPHfo. Phase 1 monitoring well 1349MW100 was first sampled as part of the Presidio-wide Groundwater Monitoring Program beginning in the Fourth Quarter 2002. The monitoring wells installed during Phase 2 were sampled for the first time as part of the Presidio-wide Groundwater Monitoring Program beginning with the Second Quarter 2003. All Building 1349 monitoring wells are now sampled as part of the Presidio-wide Groundwater Monitoring Program (Treadwell & Rollo, 2004). The analyses for groundwater monitoring well samples include TPH as gasoline (TPHg), TPHd, and TPHfo; PAHs; volatile organic compounds (VOCs); organochlorine pesticides (OCPs) and polychlorinated biphenyls (PCBs); chlorinated herbicides; dissolved oxygen; hexavalent chromium; total dissolved solids; dissolved metals; and general chemistry parameters.

Soil and groundwater results from the SI were compared with screening levels. For petroleum-related constituents in soil (i.e., TPHd, TPHfo, and PAHs), the most stringent of the following SCRs from RWQCB Order No. R2-2003-0080 (RWQCB, 2003a) were used as screening levels:

- ***Protection of Human Health, Residential Use (0 to 10 feet bgs)*** – Although planned land use at the Site is recreational, more stringent residential cleanup levels were used to facilitate decisions for future unrestricted site use.

- ***Protection of Ecological Receptors, Terrestrial (0 to 3 feet bgs)***

- ***Protection of Groundwater Resources at Drinking Water Levels (greater than 10 feet bgs)*** – Two separate cleanup levels were used depending on whether the contamination was less than or greater than 5 feet above groundwater. In the absence of SCRs and to assess PAHs in soils greater than 5 feet above groundwater, RWQCB environmental screening levels (ESLs; RWQCB, 2003b) for groundwater protection were used.

For groundwater, drinking water cleanup levels from the Cleanup Levels Document (EKI, 2002), which consist of either maximum contaminant levels (MCLs) or risk-based drinking water standards, were used as screening levels. Values for surface water or freshwater seeps were not considered applicable to the Study Area because the nearest identified seep is over 500 feet from the Site and southwest of Former Fill Site 5 (Treadwell & Rollo, 2003a).

It is noted that these screening levels, except for the ESLs used for PAHs in soil, are equivalent to the SCRs adopted by the RWQCB in Order No. R2-2003-0080 (RWQCB, 2003a) for the Presidio and are the cleanup levels selected for this CAP.

The soil sample results are discussed below. The groundwater results are described in Section 2.4.6.

Soil TPH Results

Seventy-one soil samples were analyzed for TPHd and TPHfo during the SI. In addition to the TPHd and TPHfo results, the laboratory reported concentrations of TPH within the diesel range (C12-C24) that did not match the typical diesel standard; these results are identified as “unknown” fuel hydrocarbons (TPHd-unk). The majority of TPHd-unk detections had corresponding TPHfo detections which indicates that the heavier hydrocarbon degradation products are likely contributing to the unknown diesel range quantitation. TPHd-unk does not have a specified cleanup level; therefore, TPHd-unk concentrations were evaluated using the more conservative TPHd soil cleanup levels versus the TPHfo soil cleanup levels. The TPHd, TPHfo, and TPHd-unk results are summarized in Table B-1 and shown on Figures 2-4 and 2-5. The following summarizes the detected TPH results:

- TPHd was detected in 35 of the 71 samples at concentrations ranging from 1.1 to 17,000 mg/kg. Six of the results exceeded the applicable screening levels for TPHd.

- TPHfo was detected in 31 of the 71 samples at concentrations ranging from 11 to 11,000 mg/kg. Five of the detections were above the applicable screening levels for TPHfo with one non-detect sample having a laboratory RL above screening levels.

- TPHd-unk was detected in 22 of the 71 samples at concentrations ranging from 1.3 to 2,600 mg/kg. Two of the results were above the applicable screening levels for TPHd.

Soil PAH Results

A total of 80 soil samples, including seven quality control duplicate samples, were collected and analyzed for PAHs during the SI. The PAH results are summarized in Table B-2 and shown on Figures 2-4 and 2-5. The following three PAHs had concentrations exceeding screening levels:

- Benzo(a)pyrene was detected in 34 of the 80 samples at concentrations ranging from 0.0019 to 0.260 mg/kg. Nine of these detections exceeded the applicable soil screening level and one non-detect sample had an RL greater than the applicable soil screening level.

- Chrysene was detected in 30 of the 80 samples at concentrations ranging from 0.0016 to 19 mg/kg. One of these detections at 19 mg/kg exceeded the applicable soil screening level.

- Dibenzo(a,h)anthracene was detected in 32 of the 80 samples at concentrations ranging from 0.0021 to 0.23 mg/kg. Three of these detections exceeded the applicable soil screening level.

2.4.6 Groundwater

Groundwater samples for the Study Area have been collected during the 1995-1996 SI, the 2002-2003 SI, and as part of the Presidio-Wide Groundwater Monitoring Program (*Semiannual Groundwater Monitoring Report, First and Second Quarters 2004* – Treadwell & Rollo, 2004). Tables B-5 through B-11 present the 2003 SI and quarterly groundwater sampling results. The groundwater results from the 1995-1996 SI are discussed in Section 2.4.1 and presented in Appendix C. Figure 2-7 summarizes the analytical results from the SI grab groundwater samples and groundwater monitoring wells in the Study Area that had observed concentrations of chemicals in excess of cleanup levels, with the exception of select metals to be discussed below.

It should be noted that grab groundwater samples collected from soil borings during SI activities were for screening purposes only. Several factors, including high turbidity and possible cross-contamination as a result of drilling through overlying impacted soil zones, may have affected the data quality of these samples. As such, grab groundwater analytical results may not be indicative of actual groundwater conditions at a given location, though they are used to evaluate nature and extent of contamination in this CAP.

As part of the Presidio-Wide Groundwater Monitoring Program (Treadwell & Rollo, 2004), groundwater samples at the Study Area are analyzed for general minerals, dissolved metals, total dissolved solids, hexavalent chromium, dissolved oxygen, OCPs, PCBs, chlorinated herbicides, VOCs, TPH, and PAHs. Analytes have been detected in various groundwater grab samples and groundwater samples from monitoring wells; however, only a few compounds have been detected above their respective cleanup levels. Compounds detected above cleanup levels include the following:

- TPHg and TPHd in one monitoring well (1349MW100) and three groundwater grab samples from the 2003 SI;

- benzene in two monitoring wells (1349MW100 and 1349MW02);

- PAHs: benzo(a)anthracene in one monitoring well (1349MW100) and dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene in one monitoring well (1349MW03);

- metals, total chromium (1349MW02, 1349MW03, and 1349MW03R), arsenic (1349MW01, 1349MW100, and 1349MW105), and nickel (1349MW103) ; and

- OCPs in five monitoring wells (1349MW100, 1349MW03R, 1349MW101, and 1349MW102, installed as part of Building 1349 SI activities and LF5GW104, installed as part of Former Fill Site 5 activities).

These results are discussed below.

Groundwater TPH Results

TPH compounds were detected in three of the 11 groundwater grab samples from the 2003 SI and one of the nine Study Area groundwater monitoring wells at levels that exceed their respective cleanup levels (Table B-6). TPH results are summarized below:

- TPHd was detected in September 2002 groundwater grab samples from 1349SB111, -108, and -103 at concentrations of 960, 24,000, and 14,000 µg/L, respectively. It is noted, however, that TPHd has not been detected in groundwater from nearby wells (i.e., 1349MW103 in the vicinity of borings 1349SB108 and -111; and 1349MW03 and -102 which are proximate to and apparently downgradient of 1349SB103). Note that well 1349MW03 was last sampled in August 2002 and has been subsequently abandoned and replaced by 1349MW03R.

- TPHd and TPHg have been routinely detected in groundwater monitoring well 1349MW100. Concentrations of TPHd and TPHg were 3,600 and 920 µg/L, respectively, in May 2004.

Groundwater VOC Results

Groundwater samples were analyzed quarterly for VOCs beginning in the fourth quarter 2002 and continuing through the first quarter 2004 as part of the ongoing Presidio-Wide Groundwater Monitoring Program (Table B-7). BTEX compounds have been detected in monitoring well 1349MW100, although only benzene has been detected above the cleanup level of 1 µg/L. The maximum concentration of benzene was in June 2003 at a concentration of 27 µg/L. The benzene concentration in well 1349MW100 was 24 µg/L during the most recent sampling event for VOCs in March 2004. There was also one detection of benzene at 1.1 µg/L in well 1349MW02 in November 2001; however, the duplicate result for this sample was 0.8 µg/L and benzene has not been detected in the well since that time. BTEX compounds were not detected above laboratory RLs or cleanup levels in the other Study Area monitoring wells.

Groundwater PAH Results

Groundwater samples from the Study Area groundwater monitoring wells have been analyzed for PAHs routinely since installation of the wells. Two (1349MW03 and -100) of the Study Area monitoring wells have had detectable concentrations of PAH compounds (Table B-9). Anthracene, benzo(a)anthracene, chrysene, fluoranthene, fluorene, naphthalene, phenanthrene, and pyrene have been detected in groundwater samples collected from well 1349MW100. Only benzo(a)anthracene concentrations have exceeded the cleanup level. Benzo(a)anthracene was detected in four of the six samples collected from this well since December 2002. The cleanup level for benzo(a)anthracene is 0.1 µg/L and all detected concentrations ranged between 0.14 and 0.53 µg/L, with the exception of a concentration of 6.2 µg/L detected in March 2004.

Dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene were detected in well 1349MW03 in November 2001 at concentrations of 0.36 and 0.17 µg/L, respectively. These concentrations exceed the laboratory reporting limits of 0.2 and 0.14 µg/L for dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene, respectively, which are selected as cleanup levels in this CAP (Section 3.2). It is noted, however, that these compounds were not detected in groundwater from this well over the three quarters of sampling conducted in 2002. Well 1349MW03 has subsequently been abandoned to accommodate Former Fill Site 5 corrective action excavation activities.

Groundwater OCP Results

OCP analyses have been performed on groundwater samples collected from Building 1349 groundwater monitoring wells on a quarterly basis as part of the ongoing Presidio-Wide Groundwater Monitoring Program. OCP analytical results are summarized in Table B-8.

Groundwater monitoring wells 1349MW100, 1349MW03R, 1349MW101, 1349MW102, and LF5GW104 are the only wells that have had detectable concentrations of OCPs. The OCP beta-BHC was detected in March 2004 at laboratory qualified concentrations of 0.08 C µg/L and 0.06 C µg/L at wells 1349MW03R and 1349MW101, respectively. The OCP gamma-BHC was detected once during December 2003 at a laboratory qualified concentration of 0.07 C J+ µg/L at well 1349MW102. Former Fill Site 5 monitoring well LF5GW104, located to the west of Building 1349, had one observed detection of beta-BHC in March 2004 (0.07 C µg/L). No other OCPs have been detected during any other quarterly monitoring event in Former Fill Site 5 monitoring wells. Wells 1349MW101, 1349MW102, 1349MW03R and LF5GW104 are all located approximately west of well 1349MW100 in the approximate area of Former Fill Site 5. The only Study Area well to have *repeated* detectable concentrations of OCPs is 1349MW100. Fifteen different OCPs have been detected in 1349MW100 at concentrations ranging from 0.06 to 6.1 µg/L. Figure 2-7 depicts the laboratory results of the 10 OCPs at 1349MW100 that have been detected above their respective cleanup levels since groundwater monitoring was initiated in December 2002.

In August 2003, a pilot study was conducted in support of the *Development of Freshwater TPH-diesel and TPH-fuel oil Point of Compliance Concentrations, Presidio of San Francisco, San Francisco, California* (BBL, 2003) to evaluate whether the centrifugation technique could be successful in removing elevated levels of pesticides in well 1349MW100 while retaining similar concentrations of petroleum hydrocarbons. The candidate well was sampled as part of the Presido-wide Groundwater Monitoring Program (Treadwell & Rollo, 2004) and chemical analyses of pesticides were conducted on both centrifuged and uncentrifuged samples. Following centrifugation, pesticides concentrations decreased only slightly. For example, heptachlor decreased from 2.6 to 2.0 µg/L. This is further discussed in Appendix D.

Groundwater Metals Results

Three dissolved metals (total chromium, arsenic and nickel) have been detected in groundwater samples from various Study Area monitoring wells during the quarterly sampling events at concentrations in excess of their respective cleanup levels. Table B-11 summarizes the analytical results for dissolved metals and corresponding cleanup levels. Groundwater samples containing concentrations of metals above the applicable cleanup levels are shown on Figure 2-8.

Total chromium has been routinely detected at concentrations in excess of the cleanup level (50 µg/L) at three monitoring wells, 1349MW02, 1349MW03, and 1349MW03R. Concentrations in excess of the cleanup level have ranged from 59 to 130 J µg/L at these wells.

Arsenic was detected at concentrations in excess of the cleanup level (10 µg/L) at three monitoring wells, 1349MW01, 1349MW100, and 1349MW105. Concentrations in excess of the cleanup level have ranged from 11 µg/L to 23 J µg/L at 1349MW100 and 10 µg/L to 12 J+ µg/L at 1349MW105. Only one exceedence of the cleanup level, 14 µg/L, was detected at 1349MW01 in December 2002.

Nickel was detected at concentrations in excess of the cleanup level (100 µg/L) at one monitoring well, 1349MW103. Concentrations of nickel in excess of the cleanup level ranged from 100 to 180 µg/L. The maximum concentration of 180 µg/L was detected in March 2004.

Appendix E provides a more detailed discussion of the occurrence of these dissolved metals at the Study Area and the nature and extent of these metals, in context with Appendix E, is further described in Section 2.5.2.

2.5 Nature and Extent of Contamination

This section presents an analysis of the nature and extent of contamination in soil and groundwater at the Study Area based on the potential source areas and results of previous investigations and corrective actions identified in Section 2.4. For the identification of impacted areas, the chemical data were compared with cleanup levels for this CAP which are introduced and selected in Section 3.2. For petroleum constituents in soil, the cleanup levels include human health (residential) from 0 to 10 feet bgs, ecological (terrestrial) from 0 to 3 feet bgs, and protection of groundwater resources (greater than 10 feet bgs); it is noted that these petroleum cleanup levels are equivalent to the FPALDR and SCR levels used during the AST and FDS removal actions and 2003 SI screening discussed in Section 2.4. For metals in soil, the cleanup levels include human health (residential) from 0 to 10 feet bgs, ecological (special-status) from 0 to 3 feet bgs, and background concentrations (predominantly for serpentinite soils). For groundwater, cleanup levels include drinking water levels (i.e., MCLs or risk-based standards).

This discussion relies on data representing current conditions in soil at the Study Area. Therefore, sample results associated with soils that were removed during the AST and FDS removal actions are not included to evaluate current nature and extent of contamination.

2.5.1 Nature and Extent of Contamination in Soil

Petroleum-related compounds and metals have been detected in soil at concentrations above cleanup levels. OCPs have not been tested in Study Area soil, though OCPs have been detected in groundwater. Below is a discussion of the nature and extent of contamination for each of these constituents in soil at the Study Area. The soil data are presented in Appendix B and C tables and summarized on Figures 2-4 through 2-6.

Petroleum-Related Compounds

The results of analyses conducted on soil indicate that TPHd (including TPHd-unk and TPHd-e), TPHfo, and PAHs are present at concentrations above applicable soil cleanup levels at the Study Area. The cleanup level exceedances, which are presented on Figures 2-4 and 2-5, indicate that soil contamination falls into two general zones: shallow soil and deep soil. In addition, residual contamination associated with the telecommunications corridor is a third zone of soil contamination. These zones are summarized below and analyzed in detail in Chapters 3 and 4:

- ***Shallow soil (0 to 10 feet bgs)***: Soil analytical results indicate that soil is impacted with the following constituents at concentrations that exceed the applicable soil cleanup levels: TPHd (including TPHd-unk and TPHd-e), TPHfo, total TPH (by immunoassay, assumed to be representative of TPHd or TPHfo), benzo(a)pyrene, dibenzo(a,h)anthracene, and chrysene. Three areas of shallow soil contamination are present at the Study Area as follows:

    1. <u>North of Former Building 1349 (in the vicinity of the Former FDS Excavation Areas)</u>: An area extending approximately 20 to 90 feet north of the former Building 1349 in the vicinity of the

previous FDS excavations contains TPH and PAHs above cleanup levels. The volume of impacted soil is estimated to be approximately 630 cubic yards.

2. North FDS: Shallow soil along a former FDS pipeline contains PAHs above cleanup levels in two areas (around borings 1349SB112 and -113). The total volume of impacted soil is estimated to be approximately 60 cubic yards
3. Northeast of telecommunications corridor and southeast of Former Building 1349: An area approximately 5 to 10 feet east-northeast of the telecommunications conduit contains TPHd-e above cleanup levels. The volume of impacted soil is estimated to be approximately 90 cubic yards.

- ***Deep soil (>10 feet bgs)***: Soil in the vicinity of 1349SB127 is impacted with TPHd at concentrations that exceed the applicable soil cleanup levels. This area of deep soil contamination falls within the boundaries of the shallow soil contamination area north of the former Building 1349. The contamination is known to extend vertically to approximately 20 feet bgs. The volume of impacted soil is estimated to be approximately 30 cubic yards.

- ***Shallow and deep soil adjacent to the telecommunications corridor***: Impacted soil was left in-place in the vicinity of the telecommunications corridor during the previous removal action. Soil in this area is impacted with TPHd and PAHs exceeding applicable soil cleanup levels. The volume of impacted soil is estimated to be approximately 380 cubic yards.

Metals

Metals detected in Study Area soils at levels exceeding applicable cleanup levels and background values are arsenic and vanadium. Serpentinite is the predominant soil lithology at the Study Area. Therefore, serpentinite background concentrations were used for an initial screening to assess if metals are present in Study Area soils at concentrations above background, although other soil types are applicable to the Study Area, as discussed below.

The background threshold concentration for arsenic in serpentinite soil is 5.4 mg/kg. Six samples within the 0 to 10 feet bgs depth interval had arsenic concentrations ranging from 5.6 to 9.5 mg/kg, exceeding this background concentration. Four of these detections were in samples collected at 10 feet bgs (at borings 1349SB02, -03, -10, and -12). Only two samples collected in shallower soils (4 feet bgs at boring 1349SB04 and 5 feet bgs at boring 1349SB05) had arsenic concentrations which also exceeded the background serpentinite concentration of 5.4 mg/kg. However, arsenic in Study Area soils is believed to be naturally occurring, based on the following:

- The 95 percent upper confidence limit on the arithmetic mean (95%UCL) concentration for arsenic in Study Area soils from 0 to 10 feet bgs is 4.4 mg/kg, which is below the background concentration for serpentinite soils of 5.4 mg/kg.

- Arsenic concentrations in Study Area soils generally increase with depth which would not be representative of a surface or near-surface release of contaminants (from the former ASTs or FDS). Arsenic concentrations in shallow soils from 0 to 6 feet bgs range up to 6.4 mg/kg with an average concentration of 3.6 mg/kg, whereas arsenic concentrations range up to 13.4 mg/kg with an average concentration of 6.3 mg/kg in deeper soils from 10 to 20 feet bgs. Additionally, four of the highest concentrations of arsenic in 0 to 10 feet bgs soils (ranging from 5.7 to 9.5 mg/kg), which exceed the serpentinite background concentration of 5.4 mg/kg, are all associated with samples collected at 10

feet bgs. It is noted that this general trend of higher arsenic concentrations in deeper soils was also observed in soils prior to the excavations performed during the AST removal.

- There appears to be a strong relationship between arsenic and iron concentrations in Study Area soils. High arsenic concentrations are typically associated with high iron concentrations. In addition, the two highest concentrations of arsenic (9.5 and 7 mg/kg) were detected in samples with two of the highest levels of iron (44,700 and 58,800 mg/kg, respectively). This indicates that elevated arsenic concentrations are likely associated with the natural geochemical environment of Study Area soils.

- A review of boring logs for samples with elevated arsenic concentrations above the serpentinite background level indicates that the sampled soils were generally mixtures of sandy clay, clayey silt, and silty sands, with varying amounts of weathered gravels. Weathered fragments of sandstone, siltstone, and shale were prevalently described in all boring logs for these samples (Montgomery Watson, 1995a). These materials are derived from the weathering of localized Sheared Rock and Jurassic/Cretaceous Sedimentary Rock Units. As noted in Section 2.1.1.2, these secondary geologic units have not be characterized geochemically in terms of background metals for the Presidio (EKI, 2002). For this reason, exceedances of the serpentinite background concentration in these samples are not necessarily indicators that the arsenic is indicative of site-related contamination, but rather could be related to background conditions.

For vanadium, only one result at 77.4 mg/kg in 1-foot bgs soil (1349SB01) slightly exceeded the cleanup level and serpentinite background concentration of 74 mg/kg. The 95%UCL concentration for vanadium remaining in Study Area soils from 0 to 3 feet bgs (which is the depth interval of concern for terrestrial ecological receptors which drive the cleanup level for vanadium) is 70.2 mg/kg, which is below the serpentinite background concentration.

Furthermore, as discussed in Section 2.4.1, a statistical evaluation of metals, including an analysis of their occurrence with TPH constituents, was conducted in the 1995 SI Report (Montgomery Watson, 1995). The evaluation concluded that arsenic and vanadium levels in soil at the Study Area are unrelated to TPH and are likely naturally occurring.

Based on this evaluation, it is concluded that residual metals concentrations in soil at the Study Area are below cleanup levels and/or are naturally occurring.

OCPs

OCPs have not been analyzed in soil samples at the Study Area. Based on the results of groundwater monitoring, OCPs appear to be limited to the area around well 1349MW100. Soil in this area was previously excavated to a depth of 12 feet bgs during the AST removal program (Section 2.4.2). Therefore, OCPs are not expected to be currently present in soil at levels that would pose a risk to human health or the environment at the Study Area.

2.5.2 Nature and Extent of Contamination in Groundwater

TPHd, TPHg, benzene, benzo(a)anthracene, dibenzo(a,h)anthracene, and indeno(1,2,3-c,d)pyrene, as well as several OCPs and metals have been detected in groundwater at concentrations above cleanup levels. Below is a discussion of the nature and extent of contamination for each of these constituents in groundwater at the Study Area. The groundwater data are presented in Tables B-5 through B-11 and summarized on Figures 2-7 and 2-8.

TPH

Grab groundwater samples from four locations from the 1995-1996 SI (1349SB25, -27, -22, and -19) and three locations from the 2003 SI (1349SB111, -108, and -103) had elevated TPHd concentrations; however, monitoring wells installed upgradient and downgradient from these boring locations have no groundwater samples with TPHd exceedances since they were installed and first sampled during the second quarter of 2003. TPHd and TPHg have only been detected in excess of the cleanup level at one monitoring well, 1349MW100.

VOCs

Benzene is the only BTEX compound detected at Study Area monitoring wells in excess of the cleanup level. Benzene has routinely been detected in excess of the cleanup level in one monitoring well, 1349MW100. The low benzene concentration detected in well 1349MW02 was non-repeatable.

PAHs

Benzo(a)anthracene has been detected at concentrations in excess of the cleanup level in one monitoring well, 1349MW100. One groundwater monitoring well (1349MW03, which has subsequently been abandoned) had detectable concentrations of dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene above cleanup levels in November 2001, but these compounds were not detected in the well over the three quarters of sampling conducted in 2002.

OCPs

Samples of groundwater from monitoring well 1349MW100 consistently contain concentrations of OCPs above the applicable drinking water cleanup levels. No other Study Area wells or adjacent Former Fill Site 5 wells have had detectable concentrations of OCPs above the applicable cleanup levels for the Study Area. The low concentrations detected in other wells have been non-repeatable and other results for OCPs in those wells were below laboratory RLs.

The occurrence of OCPs at 1349MW100 is not clearly related to any previous Building 1349 operational activities. Appendix D provides a discussion of the properties and occurrence of OCPs in relation to the conditions observed at the Study Area. Appendix D also provides several scenarios that could potentially account for the occurrence of OCPs at the Study Area. Although there are several potential scenarios that could explain the occurrence of OCPs at 1349MW100, there is no clear evidence that any of the scenarios actually occurred at the Study Area and all are based on speculation. Most of the soil column above and immediately adjacent to 1349MW100 has already been excavated as part of previous corrective actions and therefore, the opportunity to further investigate the historic source of the OCPs detected in 1349MW100 is hindered.

Metals

The dissolved metals, total chromium, arsenic, and nickel have been detected in Study Area monitoring wells at concentrations in excess of the cleanup level as follows:

- Total chromium has been detected at concentrations in excess of the cleanup level (50 µg /L) at three monitoring wells, 1349MW02, 1349MW03, and 1349MW03R.

- Arsenic was detected at concentrations in excess of the cleanup level (10 µg/L) at three monitoring wells, 1349MW01, 1349MW100 and 1349MW105.

- Nickel was detected at concentrations in excess of the cleanup level (100 µg/L) at one monitoring well, 1349MW103.

Concentrations and distributions of these and other trace elements analyzed in groundwater samples suggest it is unlikely that these concentrations represent significant impacts associated with past activities at the Study Area. Rather, it is likely that the limited detections above cleanup levels reflect naturally occurring metals. For example, elevated naturally occurring chromium has been documented in Presidio-wide groundwater (EKI, 2002). The elevated concentrations of chromium are related to naturally occurring chromium in serpentinite, which has also been documented to have elevated concentrations of nickel (EKI, 2002). As discussed in Section 2.5.1, Study Area soil is characterized as slope debris and ravine fill deposits derived from underlying bedrock including serpentinite, shale/siltstone, sandstone, and interbedded weathered clay and silt. Both Study Area soil and the underlying bedrock are understood to contain naturally occurring arsenic, as discussed in Section 2.5.1, based on the statistical evaluation of arsenic concentrations in Study Area soil.

It should be noted that it is common to observe localized variability in concentrations of naturally occurring metals in groundwater. Geochemical variations (and resulting variations in concentrations of metals in groundwater) observed at the Study Area, likely reflect influence from past site activities as well as natural variability. In particular, slightly elevated concentrations of metals in 1349MW100 are likely associated with the development of anoxic conditions due to readily degradable organic compounds associated with releases of diesel or fuel oil. Introduction of petroleum hydrocarbons as a food source for bacteria helped modify geochemical conditions, creating anoxic/low oxic conditions which in turn changed the partitioning relationships among metals, such that aqueous concentrations at some locations slightly exceed groundwater cleanup levels. Additional variations in concentrations of metals in groundwater are likely associated with natural variability in geochemistry across the Study Area. Specifically, slightly elevated concentrations of metals in 1349MW105 are likely associated with higher pH values observed in this area. The observed variability of these constituents and geochemistry are discussed in greater detail in Appendix E. Based on these observations, elevated metals concentrations in groundwater above cleanup levels are considered to be associated with the geochemical conditions at the Study Area.

3. Summary of Site Risks

This section presents the remedial action objectives (RAOs) and identifies the cleanup levels, contaminants of concern (COCs), and remedial units (RUs) for this CAP.

3.1 Remedial Action Objectives (RAOs)

RAOs are statements of the general goals of an environmental cleanup. For the cleanup remedies to be conducted at the Study Area, the RAOs include the following:

- Protection of human health and the environment;
- Cost-effective cleanup of the Study Area consistent with its potential land use;
- Compliance with State and Federal environmental laws;
- Consistency of selected remedial alternatives at the Study Area with the overall transformation of the Presidio into a national park site; and
- Preference for permanent ("clean closure") remedies whenever practicable, cost-effective, and consistent with current or anticipated land use.

3.2 Development of Cleanup Levels and Identification of COCs

This section presents the Study Area corrective action soil and groundwater cleanup levels which are used to evaluate and select COCs. Chemical-specific regulatory levels were adopted as CAP cleanup levels, when available. The chemical-specific regulatory levels include SCRs for petroleum hydrocarbons and related constituents in soil adopted by the RWQCB in Order No. 92-2003-0080 (RWQCB, 2003a) and Federal and California State MCLs for chemicals in groundwater. In the absence of SCRs or MCLs, Presidio-specific risk-based cleanup levels presented in the Cleanup Levels Document (EKI, 2002) were selected.

The Cleanup Levels Document identifies several steps to select chemical- and site-specific cleanup levels (EKI, 2002). For soil, this includes identification of the following: impacted media, predominant soil lithology, planned human land use (residential, recreational, or commercial/industrial), planned ecological land use (including the presence of special-status species), the presence of petroleum related chemicals, depth to groundwater, and resources to be protected. The most stringent soil cleanup level is then selected as the applicable cleanup level. For groundwater or surface water, the following attributes must be identified: type of water body and level of protection required. The most stringent groundwater cleanup level is then selected as the applicable cleanup level. Accordingly, Presidio cleanup levels are media, location, and depth-specific.

3.2.1 Soil Cleanup Levels

For petroleum-related constituents in Site soils (i.e., TPHd, TPHfo, and PAHs), the most stringent of the following SCRs from RWQCB Order No. R2-2003-0080 (RWQCB, 2003a) were selected as cleanup levels:

- ***Protection of Human Health, Residential Use (0 to 10 feet bgs)*** – Although planned land use at the Site is recreational (EKI, 2002), more stringent residential cleanup levels were selected to facilitate decisions for future unrestricted Site use.

- ***Protection of Ecological Receptors, Terrestrial (0 to 3 feet bgs)***

- ***Protection of Groundwater Resources at Drinking Water Levels (greater than 10 feet bgs)*** – Two separate cleanup levels were selected depending on whether the contamination was less than or greater than 5 feet above groundwater. Historically, the minimum depth to groundwater at the Site is 25 feet bgs. Therefore, for the 10 to 20 foot bgs depth interval, it was assumed that the contamination was greater than 5 feet above groundwater. For depths over 20 feet, the contamination was evaluated on a location-specific basis to determine if it was within 5 feet of groundwater, based on historical groundwater measurements.

Non petroleum-related compounds detected in Site soils are metals. The following cleanup levels from the Cleanup Levels Document (EKI, 2002) are applicable for metals in soil:

- ***Protection of Human Health, Residential Use (0 to 10 feet bgs)*** – Although planned land use at the Site is recreational (EKI, 2002), more stringent residential cleanup levels were selected to facilitate decisions for future unrestricted Site use.

- ***Protection of Ecological Receptors, Special-Status (0 to 3 feet bgs)*** – The Site falls within a special-status species ecological area and historic forest zone (EKI, 2002).

- ***Background Concentrations for Serpentinite*** – The predominant lithology at the Site is serpentinite or soils that, in part, are derived from serpentinite components of the Franciscan Formation bedrock (slope debris and ravine fill as described in Section 2). Therefore, serpentinite background concentrations were used for an initial screening to assess if metals are present in Study Area soils at concentrations above background. However, as discussed in Section 2.1.1.3, the slope debris and ravine fill deposits at the Study Area are derived from local weathered bedrock sources, including serpentinite, shale/siltstone, sandstone, and interbedded weathered clay and silt. The significance of this is that these secondary geologic units (i.e. the Sheared Rock and Jurassic/Cretaceous Sedimentary Rock) have not been characterized geochemically in terms of background metals for the Presidio (EKI, 2002). Hence, these Study Area units may have background metals "signatures" that differ from the primary soil or bedrock types and therefore, can be confused with contamination (EKI, 2002). For this reason, serpentinite background concentrations are selected as cleanup levels, in conjunction with an evaluation of background trends on a sample-specific basis.

The most stringent of the human health and ecological cleanup levels was selected as the cleanup level for each metal, except in cases where background concentrations where higher, in which case background concentrations were selected as the applicable cleanup levels.

Chemical-specific Site cleanup levels are presented in Table 3-1 for the chemicals detected in soils. The Presidio-Wide Quality Assurance Project Plan (QAPP; Tetra Tech, 2001) analytical RLs and laboratory RLs are also listed. Although in several cases the QAPP analytical RLs exceed the cleanup levels, the laboratory RLs are below the cleanup levels for all compounds listed.

3.2.2 Groundwater Cleanup Levels

Groundwater cleanup objectives selected for this CAP are drinking water levels. This is in keeping with the RWQCB's Basin Plan and Order No. R2-2003-0080, which designate municipal and domestic supply as a beneficial use for groundwater within the Marina and Coastal Bluffs Groundwater Basins. However, it is noted that due to the complex hydrology in the vicinity of the Study Area and technical limitations, including low specific yield of wells in the area, the potential for future groundwater development for supply is extremely low.

Drinking water cleanup levels from the Cleanup Levels Document (EKI, 2002), which consist of either MCLs or risk-based drinking water standards, were selected as cleanup levels for the Study Area. For several chemicals, drinking water standards are not available. In these cases, drinking water ESLs developed by the RWQCB were selected as cleanup levels (RWQCB, 2003b). Values for surface water or freshwater seeps were not considered applicable to the Study Area because the nearest identified seep is over 500 feet from the Site and southwest of Former Fill Site 5 (Treadwell & Rollo, 2003a).

Site-specific groundwater cleanup levels are presented in Table 3-2. The QAPP analytical RLs (Tetra Tech, 2001) and laboratory RLs are also listed. Although in several cases the QAPP analytical RLs exceed the cleanup levels, the laboratory RLs are below the cleanup levels for all compounds listed, except for dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, aldrin, heptachlor, and heptachlor epoxide; for these five chemicals, the laboratory RLs were selected as cleanup levels.

3.2.3 Soil COCs

Figures 2-4 through 2-6 show concentrations of COCs exceeding cleanup levels in soil. As discussed in Section 2.5.1, TPHd (represented by TPHd, TPHd-e, and TPHd-unk), TPHfo, and the following six PAHs were found in soil at concentrations greater than applicable cleanup levels: benzo(a)pyrene, dibenzo(a,h)anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene. These chemicals are selected as COCs in soil for the Study Area.

As discussed in Section 2.5.1, residual metals concentrations exceeding cleanup levels in soil at the Study Area are likely naturally occurring. Therefore, metals are not selected as soil COCs for this CAP.

The following are COCs by area of soil impacts:

- COCs for shallow soil are TPHd, TPHfo, benzo(a)pyrene, dibenzo(a,h)anthracene, and chrysene.
- The COC for deep soil is TPHd.
- COCs for the telecommunications corridor are TPHd, benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene.

3.2.4 Groundwater COCs

Figures 2-7 and 2-8 show concentrations of COCs exceeding cleanup levels in groundwater. As discussed in Section 2.5.2, compounds detected at concentrations above applicable cleanup levels in groundwater include the following: TPHd, TPHg, benzene, benzo(a)anthracene, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, OCPs, and metals. These chemicals are discussed below:

- TPHd, TPHg, benzene, and benzo(a)anthracene have routinely been detected above cleanup levels in groundwater at well 1349MW100 and are therefore, retained as groundwater COCs.

- Dibenzo(a,h)anthracene and indeno(1,2,3-c,d)pyrene were detected above cleanup levels in well 1349MW03 in November 2001 but were not detected during the last three quarters of monitoring from this well in 2002. Also, they have not been detected in other Study Area wells for the last three years of groundwater monitoring. Therefore, these two compounds are not retained as groundwater COCs.

- As discussed in Section 2.5.2 and Appendix E, metals concentrations above cleanup levels in groundwater are considered to be associated with the geochemical environment of the Study Area. Although it is understood that the geochemical environment in some areas within the Study Area has been altered by the natural degradation processes of petroleum hydrocarbons, geochemical conditions exist in some portions of the Study Area in the absence of petroleum hydrocarbon impacts that result in concentrations of metals above groundwater cleanup levels (e.g., arsenic in 1349MW105). In areas impacted by petroleum hydrocarbons, over time, as the petroleum hydrocarbons are consumed by natural processes, natural partitioning relationships amongst metals will be reestablished. In the mean time, there is no evidence for significant mobility of these metals within the groundwater at the Study Area. Elevated concentrations of metals above the cleanup levels are limited to the vicinity of individual wells and no apparent metals “plumes” are indicated. As discussed in Appendix E, modeling shows that transport of metals under worst case conditions is extremely limited. However, arsenic is retained as a COC for the Study Area.

- Lacking conclusive evidence for any particular source scenario (Section 2.5.2 and Appendix D), the occurrence of OCPs at 1349MW100 is not clearly related to any previous Building 1349 operational activities. However, OCPs have been retained as a COCs for evaluation of potential corrective actions.

In summary, the following compounds have been selected as COCs for groundwater in the Study Area:

- TPHd and TPHg;
- benzene;
- benzo(a)anthracene; and
- OCPs; and
- arsenic.

Although not retained as COCs, dissolved metals such as chromium and nickel will continue to be monitored at the Study Area.

3.3 Identification of Remedial Units

Based on the cleanup level exceedances shown on Figures 2-4 through 2-8, the following RUs have been selected for the Study Area to be evaluated under the CAP process:

- Shallow Soil (0 to 10 feet bgs);
- Deep Soil (>10 feet bgs);
- Telecommunications Corridor Soil; and
- Groundwater.

The soil and groundwater units are summarized in Table 3-3. The approximate areas of these RUs are shown on Figure 3-1. The total volume of impacted soil in the three soil RUs is approximately 1190 cubic yards as summarized in Table 3-3.

The lateral and vertical extent of the RUs was determined by evaluating the location of former source areas and presence of COCs above cleanup levels using previous data collected at the Study Area. In some cases, the limits of the RUs are not well delineated by sample data. In these cases, assumptions were made based on the limited data. Final limits of the RUs will be determined, as applicable, during implementation of the corrective actions described in Section 5.0.

3.3.1 Shallow Soil

The Shallow Soil RU is comprised of three distinct areas (Areas 1 through 3), as follows (Figure 3-1):

- ***Shallow Soil Area 1***: Area 1 encompasses the Former FDS Remedial Excavation areas. The southern, western, and northern limits of this RU are well delineated by SI, FDS, and AST remedial excavation samples. Although the eastern boundary of the RU is not well delineated by samples, it is likely limited to the vicinity of the former FDS pipelines. The vertical limit of this RU was selected as 10 feet bgs. Contamination in this area has been found in soils to 20 feet bgs. However, because different cleanup levels apply to the 0 to 10 feet bgs soil interval than deeper soils and remedial technologies may be different for shallow and deep soils, a vertical limit of 10 feet bgs was selected for Shallow Soil Area 1. Contamination extending deeper than 10 feet bgs is considered part of the Deep Soil RU (Section 3.3.2). The approximate volume of soil within Shallow Soil Area 1 is 630 cubic yards.

- ***Shallow Soil Area 2***: Area 2 encompasses two small areas along the northern end of the former FDS pipeline within the Study Area. The lateral extent of this RU is likely limited to the vicinity of the former FDS pipelines. The vertical extent of the COC exceedances in Area 2 is estimated to be approximately 3 feet bgs, because only the trench backfill material is suspected of containing COCs above the cleanup levels. The approximate volume of soil within Shallow Soil Area 2 is 60 cubic yards.

- ***Shallow Soil Area 3***: Area 3 encompasses an area directly northeast of the telecommunications conduit. This area includes residual soil contamination that was left in-place underneath the AST removal excavation Area 2. The lateral extent of this RU is likely limited to the area surrounded by the former excavation boundary as post-excavation confirmation samples collected in the area confirmed that cleanup levels were achieved in the area. The shallow extent of this unit varies from between 2 to 8 feet bgs (the bottom of the previous excavation) to a maximum of 10 feet bgs (samples collected deeper than 10 feet bgs during the 1995-1996 SI indicated that COCs are below cleanup levels). The approximate volume of soil within Shallow Soil Area 3 is 90 cubic yards.

3.3.2 Deep Soil

The Deep Soil RU consists of soil within a small area (around boring 1349SB127) at depths greater that 10 feet bgs, as presented on Figure 3-1. The lateral extent of this RU is well delineated to the north, south, and east by borings 1349SB127, -125, and -126, respectively. Samples collected in these three borings from 10 to 25 feet bgs had no COCs detected above cleanup levels. To the west, the deep soil unit is not well delineated, except by boring 1349SB24 which is located approximately 50 feet away. The vertical extent of this RU is assumed to be

approximately 22 feet bgs, based on detections of COCs above cleanup levels to 20 feet bgs but not at 25 feet bgs. The approximate volume of the Deep Soil RU is 30 cubic yards.

3.3.3 Telecommunications Corridor Soil

The Telecommunications Corridor Soil RU is a wedge-shaped mass of impacted soil beneath the telecommunications line adjacent to Washington Boulevard. This soil was left in place after previous remedial excavations on the east and west sides of the telecommunications conduit that runs along the east side of Washington Boulevard because it was technically impractical to remove it without jeopardizing the integrity of the conduit. The conduit is 2- to 2.5-feet wide and 2.5-feet deep and the top of the conduit occurs at approximately 1-foot below grade. The vertical extent of this RU is assumed to extend deeper than 12 feet bgs, which is the maximum depth of the previous soil excavations in the area. The contamination may extend to groundwater which is approximately 30 feet bgs. Although different cleanup levels apply to the 0 to 10 feet bgs soil interval than deeper soils, this remedial unit was evaluated as one unit because of its location under the existing telecommunications corridor. The lateral extent of this RU is likely limited to the area surrounded by the former remedial excavation as soil samples collected from borings 1349SB117 through 1349SB120 did not have COC exceedances (Figure 2-4). The approximate volume of the Telecommunications Corridor Soil RU is 380 cubic yards.

3.3.4 Groundwater

Based on groundwater monitoring data, the main Groundwater RU is believed to be limited to an area around one well, 1349MW100, in the middle of the Former Building 1349 Area 2 and 3 remedial excavations on the western part of the Study Area. The COCs exceeding respective cleanup criteria at this well include TPHg, TPHd, benzene, PAHs, arsenic, and OCPs, as presented in Figures 2-7 and 2-8. The Groundwater RU also includes well 1349MW105 where only arsenic has been detected consistently above the cleanup level due to hydrogeochemical alterations of groundwater from petroleum hydrocarbon impacts.

4. Evaluation of Corrective Actions

This section presents the evaluation of corrective actions for each Study Area RU. Section 4.1 identifies the evaluation criteria used in the CAP. Potential remedial technologies that could be used to achieve the RAOs are discussed in Sections 4.2 and 4.3. Section 4.4 discusses the screening of these remedial technologies pursuant to screening criteria, and Section 4.5 organizes combinations of viable technologies into corrective action alternatives and evaluates these alternatives against the corrective action selection criteria. Finally, the recommended corrective action alternatives are presented in Section 4.6.

4.1 Identification of Evaluation Criteria

Factors that will be used to evaluate corrective action alternatives were applied to initially screen potential remedial technologies identified for the Shallow Soil RU, the Deep Soil RU, the Telecommunications Corridor Soil RU, and the Groundwater RU at the Study Area. The screening criteria are technical effectiveness, implementability, and cost.

4.1.1 Technical Effectiveness

Screening Criteria 1 - Technical effectiveness, refers to the ability of a technology to address: 1) the estimated area or volumes of media requiring remediation to meet the RAOs; 2) the potential impacts to human health and the environment during implementation and any construction; and 3) the long-term reliability and proven history of the technology with respect to the types of chemicals and conditions at similar sites.

4.1.2 Implementability

Screening Criteria 2 - Implementability, refers to both the technical and institutional feasibility of implementing a particular remedial technology, including: 1) the likelihood of obtaining permits and approvals from regulatory agencies; 2) availability of appropriate treatment, storage, and disposal facilities; and 3) availability of the equipment, materials, and skilled workers necessary to implement the particular technology and access to contaminated material (such as underground utilities like the telecommunications conduit).

4.1.3 Cost-Effectiveness

Screening Criteria 3 - Cost effectiveness, includes assessing the relative capital and operation and maintenance (O&M) costs associated with a particular technology. Costs are estimated using best engineering judgment at the time of the estimate. Cost-effectiveness weighs required expenditures against potential benefits, and is used to eliminate options that are substantially more expensive than other process options providing the same level of protection.

4.2 Identification of Potential Soil Remedial Technologies for Corrective Action

The remediation technologies that are proposed for each of the soil RUs to develop corrective action alternatives are described in the following sub-sections. Table 4-1 provides a summary of potential remedial technologies considered for all RUs.

4.2.1 No Action

For this alternative, soil would be left in place. No additional control or protection of human health and the environment would be implemented for the contamination present other than reduction of COCs from naturally occurring degradation. There is negligible cost associated with this alternative.

4.2.2 Excavation and Off-site Disposal

The objective of this alternative would be to remove contaminated soil from the RU. Conventional excavation technologies (e.g. excavators, backhoes, etc) can remove soil to approximately 10 feet bgs without having to shore the sidewalls of the excavation or having considerable health and safety concerns. During past activities at the Presidio, excavations have been completed to depths between 12 and 15 feet bgs; however, at the Study Area weathered bedrock of the Franciscan Formation may render excavation infeasible if relatively competent bedrock is encountered. Excavated soil would be sampled for waste profiling then transported and disposed at an off-site, permitted waste management facility. Confirmation soil sampling of the bottom and sidewalls of the excavation would be performed to ensure all accessible contaminated soil was removed before placing clean fill to a specified elevation. This technology removes the contaminants from the Study Area. However, during implementation, there would be limited short-term exposure to contaminants for workers.

4.2.3 Capping

Capping involves placement of an engineering control (cap) over soil to isolate soil, limit human and ecological contact with soil, and/or reduce the infiltration of water and leaching of contaminants. This technology minimizes the potential for human health and environmental risks. Impacted soil would either be directly covered or soil would be excavated to a depth that would allow placement of a cap. Soil would be capped with soil of low permeability (10 -6 cm/s) or synthetic material such as a geosynthetic clay liner (GCL). The purpose of this layer is to prevent infiltration (mitigate leaching of contaminants into underlying groundwater). The cap would be covered with an appropriate soil and vegetation in accordance with the Vegetation Management Plan (VMP; Trust and NPS, 2001). Excavated material and soil would be removed for off-site disposal or recycling. The remedial technology of capping leaves a majority of contaminated soil in place. Therefore, a land use control (LUC) would be required in conjunction with capping to increase the effectiveness of this technology.

4.2.4 Land Use Controls

The LUC is a non-engineering measure designed to limit exposure to contaminants left in place in soil at concentrations above levels considered protective for future site use. Under this alternative, soil would remain in place and LUCs would be implemented to restrict access to the contamination. Implementation of LUCs would restrict future site disturbance and maintain site cover to minimize human or environmental exposure. The Study Area RUs are located in Area B of the Presidio. Existing and planned land uses in Area B are

directed by the Trust through its comprehensive land use and management plan, the PTMP (Trust, 2002). LUCs for Area B remediation sites include restricting or controlling site uses by administrative procedures such as preparing a site-specific addendum to the Presidio Trust's Land Use Control Master Reference Report (LUCMRR). The Trust would notify the RWQCB of any proposed action that may disrupt the effectiveness of the LUCs, and any proposed action that could alter or eliminate the continued need for LUCs. LUCs may be considered in conjunction with other remedial technologies to enhance effectiveness. LUCs for the soil RUs are only applicable for the Shallow Soil RUs for contamination from 0 to 10 feet bgs, as the cleanup criteria for soil below 10 feet bgs are based on protection of groundwater only.

4.2.5 In Situ Treatment

In situ treatment technologies involve the reduction of the toxicity, mobility, or mass of COCs present in the subsurface. Treatment technologies evaluated in this CAP include bioremediation technologies and sparging and extraction technologies which are described below.

Bioremediation technologies rely on microorganisms to biodegrade the contaminants. Two specific examples are as follows:

- Bioventing stimulates the indigenous microorganisms to biodegrade organic constituents absorbed to soils in the unsaturated zone by increasing the transport of oxygen within the subsurface. Air injection wells can be installed by standard well-drilling methods and can be utilized to pump compressed air into the vadose zone. The increased supply of oxygen (as air) serves to aerate the soil and enhance the rate of naturally occurring aerobic biodegradation. Bioventing uses readily available equipment.

- Bioremediation can be enhanced by the addition of oxygen-releasing products into the subsurface via soil borings. Like bioventing, the increased supply of oxygen serves to accelerate the rate of naturally occurring aerobic contaminant biodegradation. This is typically accomplished by circulating a water-based solution through contaminated soil using a combination of either spray irrigation, or injection wells, groundwater pumping wells, and groundwater reinjection wells. This treatment is applicable only to saturated soil.

Sparging and extraction technologies include SVE. SVE is an in situ remedial technology that reduces concentrations of volatile constituents in petroleum products adsorbed to soils in the unsaturated zone. In this technology, a vacuum is applied through wells near the source of contamination in the soil to induce a controlled flow of air. Volatile constituents in the vapor phase are drawn toward the extraction wells. Extracted vapor is then treated as necessary before being released to the atmosphere. The increased air flow through the subsurface can also stimulate biodegradation of some of the contaminants, especially those that are less volatile, if the soil moisture can be maintained at an adequate level. Wells may be either vertical or horizontal. The target contaminants for SVE include VOCs and some semivolatile organic compounds (SVOCs). It is not effective for heavier hydrocarbons such as TPHd.

4.3 Identification of Potential Groundwater Remedial Technologies for Corrective Action

The remediation technologies that are proposed for the groundwater RUs to develop corrective action alternatives are described in the following sub-sections. Table 4-1 provides a summary of potential remedial technologies considered for groundwater.

It is noted that the groundwater cleanup objectives selected for this CAP are drinking water levels (Section 3.2.2). This is in keeping with the RWQCB's Basin Plan and Order No. R2-2003-0080, which designate municipal and domestic supply as a beneficial use for groundwater within the Marina and Coastal Bluffs Groundwater Basins. However, due to the complex hydrology in the vicinity of the Study Area and technical limitations, including low specific yield of wells in the area, the potential for future groundwater development for supply is extremely low. In consideration of these factors, the groundwater remedial technologies below were evaluated in this CAP to provide a range of cleanup alternatives for groundwater at the Study Area and comply with the California State Water Resources Control Board (SWRCB) Resolution No. R2-49 which specifies that groundwater will be consistent with maximum benefit to the people of the State, not unreasonably affect present and anticipated beneficial uses of such water, and not result in water quality less than that prescribed in local plans and policies.

4.3.1 No Action

For this alternative, groundwater would be left in place and existing groundwater monitoring wells would be abandoned. No additional control or protection of human health and the environment would be implemented for the contamination present. Although conditions favorable for natural degradation of COCs have been identified, this alternative provides no further evidence that these processes are occurring over time and that COC concentrations show stable or decreasing trends. There is negligible cost associated with this alternative.

4.3.2 Groundwater Monitoring

For this alternative, groundwater would be monitored over a specified time period to demonstrate if observed concentrations of COCs are decreasing or stabilized, confirm the extent of the groundwater plume, and evaluate the effectiveness of the selected soil remedies. Long-term performance monitoring is a fundamental component of this remedial technology. Under certain conditions, natural subsurface processes such as dilution, dispersion, volatilization, biodegradation of contaminants, adsorption to soil particles, and chemical reactions with subsurface materials reduce contaminant concentrations to acceptable levels. Many contaminants are prevented from migrating off-site because they are adsorbed to soil particles or aquifer materials. Dilution and dispersion do not destroy contaminants, but can significantly reduce their potential risk at many sites. This technology is used widely for petroleum hydrocarbons because the biodegradation of these contaminants is well documented. This technology has also been used for VOCs, SVOCs, arsenic, and pesticides to demonstrate stable or decreasing conditions.

4.3.3 Land Use Controls

Under this alternative, groundwater would remain in place and LUCs would be implemented to restrict use of groundwater in the vicinity of the Study Area. Due to the complex hydrology in the vicinity of the Study Area and technical limitations, including low specific yield of wells in the area, the potential for future groundwater development for supply is extremely low. However, municipal and domestic supply is a beneficial use for groundwater within the Marina and Coastal Bluffs Groundwater Basins, according to the Basin Plan and RWQCB Order No. R2-2003-0080. Thus, an LUC for groundwater would act as an administrative control to restrict development of groundwater for municipal or domestic supply and would be implemented in consultation with the RWQCB.

4.3.4 In Situ Treatment

In situ groundwater treatment technologies involve the reduction of the toxicity, mobility, or mass of COCs present in the groundwater. Treatment technologies evaluated include enhanced bioremediation, air sparging, and chemical oxidation technologies.

Enhanced bioremediation of groundwater involves stimulating the growth of naturally occurring microorganisms in order to promote aerobic degradation of contaminants. This can be done by using products, such as ORC® (a proprietary formulation of phosphate-intercalated magnesium peroxide that time releases oxygen when hydrated) or hydrogen peroxide, to release oxygen into the groundwater. ORC® can be applied actively (injecting a slurry, straight powder application in excavation, or mixture of water and powder in excavation) or passively (filter sock placed in wells).

Air sparging is an in situ technology in which air is injected into the water-bearing zone. The compressed air is injected at a relatively high flowrate using specially-designed wells that are screened below the water table. The high flowrate “strips” the contaminants from the groundwater. A vapor extraction system is typically used to remove volatilized contaminants from the unsaturated zone, similar to the process of SVE discussed in Section 4.2.5. The added benefit of air sparging is that it provides additional oxygen to the contaminated groundwater and soil which may enhance aerobic biodegradation.

Chemical oxidation is the process where hazardous contaminants are degraded into non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. Oxidants have been able to cause the rapid and complete chemical destruction of many toxic organic chemicals. This remedial technology can be implemented for groundwater and saturated soil treatment. Two potential technologies include using peroxide with iron and ozone sparging:

- Oxidation using liquid hydrogen peroxide with the addition of ferrous iron produces Fenton’s Reagent which creates free hydroxyl radicals. These nonspecific oxidants can rapidly degrade a variety of organic compounds.

- Ozone sparging is a chemical oxidation system that is applied by injecting ozone gas into the saturated zone, a specific method of application is the Perozone™ technology which consists of injecting peroxide-coated ozone micro bubbles into the saturated zone. Ozone serves as a chemical oxidant to degrade contaminants.

4.3.5 Extraction and Treatment

Ex situ groundwater treatment technologies treat contaminated groundwater after it is pumped or lifted to the surface. The process includes installation of groundwater wells in the vicinity of groundwater impacts and pumping groundwater to an above ground treatment system. In the treatment system, groundwater is pumped through a series of canisters or columns containing activated carbon to which dissolved organic contaminants adsorb. Periodic replacement or regeneration of spent carbon is required. Limited effectiveness may be achieved on halogenated VOCs and pesticides as these constituents preferentially partition in the adsorbed phase and require the extraction of multiple pore volumes to displace the contaminant.

Ex situ technologies have certain advantages over in situ methods, typically including easier verification sampling, greater process control, and lower unit cost. However, construction and operation of the ex situ groundwater treatment unit can be high profile (visibility, odors) and not cost effective.

4.4 Screening of Remedial Technologies

In this section, the remedial technologies discussed in Sections 4.2 and 4.3 are evaluated for effectiveness in each RU. Tables 4-2 through 4-5 provide a detailed evaluation of the effectiveness of each technology for the Shallow Soil RU, Deep Soil RU, Telecommunication Corridor RU, and Groundwater RU. All in situ soil remedial technologies were eliminated due to site-specific limitations, including geology (e.g., soil permeability and subsurface heterogeneity) and COCs.

4.4.1 Shallow Soil RU

Based upon the screening of potential soil remedial technologies against the criteria listed in Section 4.1, **No Action, Excavation and Off-site Disposal, Capping, and Land Use Controls** have been retained for the Shallow Soil RU (Table 4-2). These technologies are developed as corrective action alternatives and screened in Section 4.5.

Bioventing was not retained as a remedial technology for the Shallow Soil RU due to low effectiveness. The technology can be can be limited by low permeable soil. In addition, uniform remediation would not be achieved in heterogeneous soils. The Shallow Soil RU consists of discrete volumes of contaminated material in silty clay/clayey silt (slope debris and ravine fill and weathered bedrock with evidence of secondary mineralization of fractures) which has low permeability and is heterogeneous. This lithology would likely produce preferential flow paths and thus, soil would not be remediated uniformly.

Enhanced bioremediation was not retained as a remedial technology for the Shallow Soil RU due to low effectiveness. As discussed above with bioventing, Study Area soils are such that the effectiveness of this technology would be limited and the lithology would likely produce preferential flow paths. Preferential flow paths caused by fractures in weathered bedrock or heterogeneity in soil would limit the contact between the injected fluid and contaminant which decreases the effectiveness of the treatment. This technology is also not effective in unsaturated soil.

SVE was also not retained as a remedial technology for the Shallow Soil RU due to low effectiveness. The target contaminants for SVE include VOCs and some SVOCs, but it is not effective for heavier hydrocarbons such as TPHd which is a COC for the Shallow Soil RU. The effectiveness of this technology is limited by soils or shallow bedrock with low permeability, such as those observed in the Study Area. As discussed in earlier sections of this CAP, the Study Area soils are variable, heterogeneous mixtures of sand, silt, clay, and weathered fractured bedrock with secondary remineralization of fractures, typical of slope debris and ravine fill and weathered Franciscan Formation. The Study Area lithology would likely produce preferential paths and thus, would not be remediated uniformly.

4.4.2 Deep Soil RU

Based upon the screening of potential soil remedial technologies against the criteria listed in Section 4.1, **No Action, Excavation and Off-site Disposal, and Subsurface Capping** have been retained for the Deep Soil RU (Table 4-3). These technologies are developed as corrective action alternatives and screened in Section 4.5.

Bioventing was not retained as a remedial technology for the Deep Soil RU due to low effectiveness. The technology can be can be limited by low permeable soil. In addition, uniform remediation would not be achieved in heterogeneous soils. The Deep Soil RU consists of discrete volumes of contaminated material in

silty clay/clayey silt (slope debris and ravine fill and weathered bedrock with evidence of secondary mineralization of fractures) which has low permeability and is heterogeneous. This lithology would likely produce preferential flow paths and thus, soil would not be remediated uniformly.

Enhanced bioremediation was not retained as a remedial technology for the Deep Soil RU due to low effectiveness in low permeable soils and bedrock. This technology is also not effective in unsaturated soil.

SVE was also not retained as a remedial technology for the Deep Soil RU due to low effectiveness. The target contaminants for SVE include VOCs and some SVOCs, but it is not effective for heavier hydrocarbons such as TPHd which is a COC for the Deep Soil RU. In addition, the low permeability of soil and bedrock would impede volatilization.

4.4.3 Telecommunications Corridor RU

Based upon the screening of potential soil remedial technologies against the criteria listed in Section 4.1, **No Action, Excavation and Off-site Disposal, Capping, and Land Use Controls** have been retained for the Telecommunications Corridor RU (Table 4-4). These technologies are developed as corrective action alternatives and screened in Section 4.5.

Bioventing was not retained as a remedial technology for the Telecommunications Soil RU due to low effectiveness. The technology can be can be limited by low permeable soil. In addition, uniform remediation would not be achieved in heterogeneous soils. The Telecommunications Soil RU consists of discrete volumes of contaminated material in silty clay/clayey silt (slope debris and ravine fill and weathered bedrock with evidence of secondary mineralization of fractures) which has low permeability and is heterogeneous. This lithology would likely produce preferential flow paths and thus, soil would not be remediated uniformly.

Enhanced bioremediation was not retained as a remedial technology for the Telecommunications Corridor Soil RU due to low effectiveness. As discussed above with bioventing, Study Area soils are such that the effectiveness of this technology would be limited and the lithology would likely produce preferential flow paths. Preferential flow paths caused by fractures in weathered bedrock or heterogeneity in soil would limit the contact between the injected fluid and contaminant which decreases the effectiveness of the treatment. This technology is also not effective in unsaturated soil.

SVE was also not retained as a remedial technology for the Telecommunications Corridor Soil RU due to low effectiveness. The target contaminants for SVE include VOCs and some SVOCs, but it is not effective for heavier hydrocarbons such as TPHd which is a COC for the Telecommunications Corridor Soil RU. In addition, the low permeability of soil and bedrock would impede volatilization.

4.4.4 Groundwater RU

Based upon the screening of potential groundwater remedial technologies against the criteria listed in Section 4.1, **No Action, Groundwater Monitoring, and Land Use Controls** have been retained for the Groundwater RU (Table 4-5). These technologies are developed as corrective action alternatives and screened in Section 4.5.
In situ groundwater technologies were not retained for the Groundwater RU. For bioremediation, the ability to enhance bioremediation can be limited by the subsurface conditions (heterogeneity, relatively low permeability, etc.). The success of the technology relies on the uniform delivery of the material. As described previously in Section 2.1.2.3, Study Area groundwater occurs within the anisotropic fracture system of the Franciscan

Formation. As such, the delivery of the enhanced bioremediation products would be difficult to control. In addition, these types of bioremediation are used to enhance the availability of oxygen to promote biodegradation of contaminants that degrade aerobically whereas OCPs degrade faster in anaerobic conditions.

Limitations to air sparging include uncontrolled movement of vapors if they are not captured by the SVE system. Like other injection technologies, soil heterogeneity may cause some zones to be unaffected and remain contaminated. In addition, the target contaminants for air sparging would be TPH compounds because it enhances the aerobic environment; however, this technology would not be appropriate for OCPs which degrade faster in anaerobic conditions.

The most important considerations for chemical oxidation include the effectiveness and ability to control reaction of the chemical oxidation reagents with the contaminants of interest and the effective delivery of reagents to the zone to be treated. In order to be an effective remedial treatment, the reagent must come in contact with the contaminant. Chemical oxidation works best when the matrix is homogeneous. Additionally, the oxidant contact with the contaminant is limited by diffusion in relatively low permeable soils and weathered bedrock, and the consumption of oxygen by the contaminants and native organic material. Other limitations of this alternative include handling large quantities of hazardous oxidizing chemicals due to the oxidant demand of the target organic chemicals and the potential for negative effects such as formation of toxic byproducts, production of heat and gas, resolubilization of metals, and reduction of biomass.

Extraction and treatment was also not retained as a viable alternative for the Groundwater RU. Extraction and treatment systems require a minimum groundwater flow rate to be successful and low yielding aquifers would impede the effectiveness of this treatment. As discussed previously, the specific yield of wells impacted by COCs is low, with pumping rates of as little as 0.20 gpm, which cannot be sustained without dewatering the well in less than one hour.

4.5 Development and Evaluation of Proposed Corrective Action Alternatives

The following subsections present the development of the site-specific corrective action alternatives for each RU using retained remedial technologies as identified in Section 4.4. In addition, these subsections present the evaluation of each corrective action alternative using the screening criteria presented in Section 4.1. This evaluation is summarized in Table 4-6.

The detailed costs for each alternative are developed in Appendix F. For comparison purposes, costs were developed separately for each alternative for each RU. However, it is noted that the costs for implementation of the recommended alternatives will not necessarily be additive and will be reduced when the alternatives for all Study Area RUs are implemented. For example, if excavation and off-site disposal were selected for more than one soil RU, there would likely only be one mobilization cost, assuming that the corrective actions for the soil RUs would be implemented at the same time.

4.5.1 Shallow Soil RU

Four corrective action alternatives were developed and analyzed for the Shallow Soil RU. **No Action, Excavation and Off-site Disposal, Capping, and Land Use Controls** were retained for further evaluation based on their technical effectiveness, implementability, and cost effectiveness as presented in Table 4-6.

No Action Alternative: The objective of the no action alternative is to leave existing shallow soil in place. This alternative provides no additional control or protection to human health or the environment for the petroleum-related impacts that exist at the Study Area leaving existing potential exposure pathways uncontrolled. Therefore, this alternative does not prevent ecological or human exposure to contaminated soil and does not protect against impacts to groundwater. The no action alternative provides no technical effectiveness, since no remedial action is undertaken and COCs would not be reduced, other than reduction of COCs from naturally occurring biodegradation. The no action alternative would not likely obtain approval from regulatory agencies and is therefore, not implementable. The costs for the no action alternative are low (minor administrative costs), however it is not considered cost-effective because it fails to address any site impacts and risks associated with the petroleum releases. The cost for the no action alternative is estimated at $6,000.

Excavation and Off-site Disposal Alternative: The objective of this alternative is to remove impacted shallow soil down to 10 feet bgs. The excavation and off-site disposal alternative is protective of human health, safety, and the environment, because the shallow soil contamination is removed, thereby eliminating potential human and ecological exposure to contaminants. Shallow soil would be removed to a depth of 10 feet bgs using conventional excavation equipment. Confirmation sampling would be performed on the bottom and sidewalls of the excavation areas. An approximate volume of 780 cubic yards would be removed. Excavated soil would be sampled for waste profiling, then transported off-site to a permitted waste management facility. The resultant excavation would be backfilled with approved fill material and restored with approved vegetation per the VMP (Trust and NPS, 2001). Well 1349MW103 would be abandoned before excavation and a replacement well (1349MW103R) installed after backfilling is complete. This alternative is technically effective and permanent. Contaminated soil is removed within the RU, thereby preventing potential impacts to groundwater by these contaminants. Potential exposure of workers and the public to contaminated materials during excavation and loading for off-site transport would be mitigated by engineering and dust control measures. This alternative is implementable and no significant obstacles have been identified. Additionally, long term O&M would not be required. The capital cost for the excavation and off-site disposal alternative for the Shallow Soil RU is estimated to be $400,000.

Capping: Three geotechnical caps of approximately 1700, 170, and 250 square feet (sf) would be constructed and placed above the Shallow Soil RU Areas 1, 2, and 3, respectively. Contaminated soil would be left in place at 2 feet bgs and deeper. The caps would be covered with clean fill material and topsoil appropriate for approved revegetation per the VMP (Trust and NPS, 2001). The caps would provide a barrier to infiltration and vertical migration of surface water in order to prevent leaching of contaminants in the Shallow Soil RU into groundwater. Because the contaminated soil is not removed, this alternative includes the development and implementation of LUCs to provide advance notice of site conditions in the event of future ground-disturbing activity, and to restrict future land uses compatible with safeguarding the integrity of the subsurface cap. The addition of the LUC for this alternative makes the technology more effective in order to maintain the integrity of the surface soil and cap. The estimated present worth of this alternative is $502,000, which includes estimated capital costs of $252,000 and estimated cumulative annual costs of $250,000.

Land Use Controls: The objective of this alternative is to adopt an LUC for the Shallow Soil RU to restrict disturbance of and exposure to contamination left in-place in shallow soil. The LUC would provide advance notice of site conditions in the event of future ground-disturbing activity and restrict future land uses compatible with safeguarding the integrity of the ground surface. The LUC alternative would maintain existing soil cover over the Shallow Soil RU to isolate the contaminated soil from human and environmental exposure. The contaminated soil with COC concentrations above cleanup levels extends from 2 to 10 feet bgs within the Shallow Soil RU. The LUC alternative would be easily implementable, but would require long-term O&M costs to maintain the LUC. The estimated present worth of this alternative is $80,000, which includes estimated capital costs of $10,000 and estimated cumulative annual costs of $70,000.

4.5.2 Deep Soil RU

Three corrective action alternatives were developed and analyzed for the Deep Soil RU. **No Action, Excavation and Off-site Disposal, and Subsurface Capping** were retained for further evaluation based on their effectiveness, implementability, and cost-effectiveness as presented in Table 4-6.

No Action Alternative: The objective of the no action alternative is to leave existing deep soil in place. This alternative provides no additional control to prevent potential impacts to groundwater. The no action alternative provides no technical effectiveness, since no remedial action is undertaken and COCs would not be reduced other than reduction from naturally occurring biodegradation. The no action alternative would not likely obtain approval form regulatory agencies and is therefore not implementable. The costs for the no action alternative are low (minor administrative costs), however it is not considered cost-effective because it fails to address any site impacts associated with the petroleum releases. The cost for the no action alternative is estimated at $6,000.

Excavation and Off-site Disposal Alternative: The objective of this alternative is to remove impacted deep soil below 10 feet bgs. Deep soil would be removed between 10 and 22 feet bgs using conventional excavation equipment. Confirmation sampling would be performed on the bottom and sidewalls of the excavation area. An approximate volume of 30 cubic yards would be removed. Excavated soil would be sampled for waste profiling then transported off-site to a permitted waste management facility. The resultant excavation would be backfilled with approved fill material. Well 1349MW103 would be abandoned before excavation and a replacement well (1349MW103R) installed after backfilling is complete (assumed under the Shallow Soil RU analysis). This alternative is technically effective and permanent. Contaminated soil is removed, thereby preventing potential impacts to groundwater by the removed contaminants. Potential exposure of workers and the public to contaminated materials during excavation and loading for off-site transport would be mitigated by engineering and dust control measures. Additionally, long-term O&M would not be required. It is noted that this alternative may not be implementable based on geotechnical parameters encountered during excavation. Typical equipment may not be able to effectively excavate bedrock that may become more competent with depth. The capital cost for the excavation and off-site disposal alternative for the Deep Soil RU is estimated to be $194,000.

Subsurface Capping: This alternative would be implemented assuming that the shallow soil was removed as part of the corrective action alternative for the Shallow Soil RU. Once the depth of this shallow soil excavation is reached (10 feet bgs), a geotechnical cap of approximately 250 sf would be constructed and placed above the deep soil RU. The cap would be covered with clean backfill material and topsoil appropriate for approved revegetation per the VMP (Trust and NPS, 2001). The cap would provide a barrier to infiltration and vertical migration of surface water in order to prevent leaching of contaminants in the deep soil RU into groundwater. This alternative includes the development and implementation of an LUC to provide advance notice of site conditions in the event of future ground-disturbing activity to safeguard the integrity of the subsurface cap. The estimated present worth of this alternative is $328,000, which includes estimated capital costs of $181,000 and estimated cumulative annual costs of $147,000.

4.5.3 Telecommunications Corridor RU

Four corrective action alternatives were developed and analyzed in the Study Area for the Telecommunications Corridor Soil RU. **No Action, Excavation and Off-site Disposal, Capping, and Land Use Controls** were retained for further evaluation based on their effectiveness, implementability, and cost-effectiveness as presented in Table 4-6.

No Action Alternative: The objective of the no action alternative is to leave existing soil in place. This alternative provides no additional control or protection to human health or the environment for the petroleum-related impacts that exist at the Study Area leaving existing potential exposure pathways uncontrolled. Therefore, this alternative does not prevent potential ecological or human exposures to contaminated soil and does not protect against impacts to groundwater. The no action alternative provides no technical effectiveness, since no remedial action is undertaken and COCs would not be reduced except by naturally occurring biodegredation. The no action alternative would not likely obtain approval form regulatory agencies and is therefore not implementable. The costs for the no action alternative are low (minor administrative costs), however it is not considered cost-effective because it fails to address any site impacts and risks associated with the petroleum releases. The estimated cost for this alternative is $6,000.

Excavation and Off-site Disposal Alternative: The objective of this alternative is to remove impacted soil below the telecommunications conduit. The excavation and off-site disposal alternative is protective of human health, safety, and the environment, because the soil contamination is removed, thereby eliminating potential human and ecological exposure to contaminants. The telecommunication conduit would be rerouted and Washington Boulevard would be closed. Well 1349MW100 would be abandoned before excavation and a replacement well (1349MW100R) installed after backfilling is complete. Soil would be removed to the maximum depth possible using conventional excavation equipment. There would be no access to the excavation because it would not be shored. Confirmation sampling would be performed remotely using an excavator on the bottom and sidewalls of the excavation area. Approximately 380 cubic yards of impacted soil would be removed. Excavated soil would be sampled for waste profiling then transported off-site to a permitted waste management facility. The resultant excavation would be backfilled with approved fill material and restored with approved vegetation per the VMP (Trust and NPS, 2001). This alternative is technically effective and permanent. Contaminated soil would be removed within the RU, thereby preventing potential impacts to groundwater by the excavated contaminants. Potential exposure of workers and the public to contaminated materials during excavation and loading for off-site transport would be mitigated by engineering and dust control measures. Additionally, long term O&M would not be required. It is noted that this alternative may not be implementable based on geotechnical parameters encountered during excavation. Typical equipment may not be able to effectively excavate bedrock that may become more competent with depth. The capital cost for the excavation and off-site disposal alternative for the Telecommunications Corridor Soil RU is estimated to be $420,000.

Capping: The area would be excavated to a grade of approximately 2-3 feet bgs to accommodate the construction of a geotechnical cap. This excavated material would be stockpiled and sampled for disposal. A geotechnical cap of approximately 650 sf would be constructed and placed above the Telecommunication Soil RU. The cap would be covered with clean backfill material and topsoil appropriate for approved revegetation per the VMP (Trust and NPS, 2001). The cap would provide a barrier to infiltration and vertical migration of surface water in order to prevent leaching of contaminants in the Telecommunications Soil RU into groundwater. It is noted that water which runs through the telecommunications conduit (from the upgradient direction) and leaks through joints in the conduit may provide a source of infiltration. However, the impacts from this infiltration are expected to be minor and the cap would provide a barrier to the majority of surface water infiltration through the RU. Because the contaminated soil is not removed, this alternative includes the development and implementation of LUCs to provide advance notice of site conditions in the event of future ground-disturbing activity, and to restrict future land uses compatible with safeguarding the integrity of the subsurface cap. The addition of the LUC for this alternative makes the technology more effective in order to maintain the integrity of the surface soil and cap. The estimated present worth of this alternative is $557,000, which includes estimated capital costs of $308,000 and estimated cumulative annual costs of $249,000.

Land Use Controls Alternative: The objective of this alternative is to adopt an LUC for the Telecommunications Conduit RU to restrict disturbance of and exposure to contamination left in-place in shallow soil. The LUC would provide advance notice of site conditions in the event of future ground-disturbing activity and restrict future land uses compatible with safeguarding the integrity of the ground surface. The LUC alternative would maintain existing soil cover over the Shallow Soil RU to isolate the contaminated soil from human and environmental exposure. The LUC would not be effective for deep soil (below 10 feet bgs) which contains COCs above cleanup levels protective of groundwater resources. The LUC alternative would be easily implementable, but would require long-term O&M costs to maintain the LUC. The estimated present worth of this alternative is $80,000, which includes estimated capital costs of $10,000 and estimated cumulative annual costs of $70,000.

4.5.4 Groundwater RU

Three corrective action alternatives were developed and analyzed for the Groundwater RU. **No Action, Groundwater Monitoring, and Land Use Controls** were retained for further evaluation based on their effectiveness, implementability, and cost-effectiveness as presented in Table 4-6.

No Action Alternative: The objective of the no action alternative is to leave existing groundwater in place. This alternative provides no additional control or protection to human health or the environment for the petroleum-related impacts that exist at the Study Area leaving existing potential exposure pathways uncontrolled. Under this alternative, existing groundwater monitoring would cease and Study Area monitoring wells would be abandoned. The no action alternative provides no technical effectiveness, since no remedial action is undertaken and COCs would not be reduced other than by naturally occurring degradation. Although conditions favorable for natural degradation of COCs have been identified, this alternative provides no further evidence that these processes are occurring over time and that COC concentrations show stable or decreasing trends. The no action alternative would not likely obtain approval from regulatory agencies and is therefore not implementable. The no action alternative also does not comply with the RWQCB Basin Plan, RWQCB Order No. R2-2003-0080, and SWRCB Resolution 92-49. The costs for the no action alternative are low (minor administrative costs and costs for abandonment of wells), however it is not considered cost-effective because it fails to address any site impacts and risks associated with the petroleum releases. The estimated cost for this alternative is $48,000.

Groundwater Monitoring Alternative: The objective of groundwater monitoring would be to effectively demonstrate if observed concentrations of TPHg and TPHd, VOCs, PAHs, and OCPs are decreasing or stabilized at well 1349MW100, demonstrate if the groundwater plume is limited to the area around well 1349MW100, and if the selected soil remedies have a positive effect on the dissolved-phase concentrations. Groundwater monitoring is a practicable alternative for localized groundwater impacts that are nominally above the cleanup levels for constituents of concern, sufficiently isolated from potential receptors, and/or expected to attenuate over time due to natural physical, chemical and biological processes. It is likely that site-wide aerobic conditions are present to assess the viability of various remediation technologies at the Study Area. Based on the results of the physical and biological tests conducted as part of the 1995 SI (Montgomery Watson, 1995a), the SI concluded that there are adequate naturally occurring microorganisms based on total plate counts and that neither nitrogen nor phosphorous would be limiting factors for microorganism growth. Reducing conditions are present in the vicinity of 1349MW100, as demonstrated by the low dissolved oxygen, high dissolved iron, and low sulfate (Section 2.1.2.2) which are favorable for OCP reduction. Groundwater monitoring would demonstrate whether groundwater COCs are decreasing in concentration and the impacted area is localized. In order to monitor naturally occurring degradation, sampling parameters would include groundwater COCs and dissolved metals, as well as general chemistry parameters including alkalinity, chloride, nitrate, nitrite, sulfate,

sulfite, and dissolved gases. This alternative also recommends the installation of two additional groundwater wells located approximately to the west and north of 1349MW100 to monitor TPH, PAHs and OCP concentrations. This alternative can also be implemented to monitor the effectiveness of the alternatives for soil RUs. Under this alternative, groundwater would be sampled on a quarterly basis for a period of up to five years to show that the groundwater impacts are adequately assessed, remain localized (around 1349MW100), and moving towards the cleanup goals of remediation. This alternative is in compliance with the RWQCB Basin Plan, RWQCB Order No. R2-2003-0080, and SWRCB Resolution 92-49. The estimated present worth of this alternative is $575,000 which includes estimated capital costs of $66,000 and estimated cumulative annual costs of $509,000.

Land Use Controls Alternative: The objective of the LUC alternative is to restrict the use of groundwater in the vicinity of well 1349MW100. This alternative would be effective in preventing exposure to contaminated groundwater. Also, due to the complex hydrology in the vicinity of the Study Area and technical limitations, including low specific yield of wells in the area, the potential for future groundwater development for supply is extremely low. This alternative is also easily implementable, but would require long-term O&M costs to maintain the LUC restriction on groundwater use. However, this alternative is not in compliance with the beneficial use designation for the groundwater basin as a municipal and domestic supply per the RWQCB Basin Plan, RWQCB Order No. R2-2003-0080, and SWRCB Resolution 92-49. The estimated present worth of this alternative is $80,000, which includes estimated capital costs of $10,000 and estimated cumulative annual costs of $70,000.

4.6 Recommended Corrective Actions

The recommended corrective action alternatives for each RU are summarized below. Detailed descriptions of the recommended alternatives are provided in Sections 5.2 for the soil RUs and Section 5.3 for the Groundwater RU.

As noted earlier, the costs provided above were developed in Appendix F separately for each alternative for each RU so that comparisons could be made in this CAP. Table F-7 provides an estimate of total costs for the preferred corrective actions for all Soil RUs, assuming that they are implemented at the same time. The total estimated capital cost for the recommended corrective actions for the Soil RUs, as discussed below, is $655,000. Together with the Groundwater Monitoring remedy for the Groundwater RU, the total estimated cost for the preferred corrective action for the Study Area is $1,230,000, which includes estimated capital costs of $721,000 and cumulative annual costs of $509,000.

4.6.1 Shallow Soil RU

The recommended alternative for the Shallow Soil RU is the Excavation and Off-site Disposal Alternative.

Under the recommended alternative, well 1349MW103 will be abandoned and soil contaminated with petroleum products at concentrations above the cleanup levels will be excavated to 10 feet bgs. Excavated soil will be sampled for waste characterization parameters then transported and disposed of at an off-site permitted waste management facility. The excavation activities will continue until soil confirmation sampling results indicate that cleanup levels for the soil COCs specified in Table 3-1 are met according to the soil confirmation sampling program detailed in Section 5.2. The excavation will be backfilled with clean fill and covered with appropriate topsoil and vegetation in accordance with the VMP (Trust and NPS, 2001). A replacement well (1349MW103R) will also be installed. It is noted that if contamination extends deeper than 10 feet bgs, it will be addressed as part of the preferred alternative for the Deep Soil RU (Section 4.6.2).

4.6.2 Deep Soil RU

The recommended alternative for the Deep Soil RU is the Excavation and Off-site Disposal Alternative.

Under the recommended alternative, soil contaminated with petroleum products at concentrations above the cleanup levels will be excavated between 10 and 22 feet bgs, or as deep as possible to remove all impacted soil with conventional equipment. Excavated soil will be sampled for waste characterization parameters then transported and disposed of at an off-site permitted waste management facility. The excavation activities will continue until soil confirmation sampling results indicate that cleanup levels for the soil COCs specified in Table 3-1 are met according to the soil confirmation sampling program detailed in Section 5.2. The excavation will be backfilled with clean fill and covered with appropriate topsoil and vegetation in accordance with the VMP (Trust and NPS, 2001). It is noted that abandonment and replacement of well 1349MW103 will be conducted under the preferred alternative for the Shallow Soil RU.

It is noted that if bedrock conditions preclude excavation of all impacted soil within the Deep Soil RU, the contamination will be left in-place and groundwater monitoring will be conducted to confirm that groundwater is not impacted by soil COCs (evaluated under the Groundwater RU). Current and historical groundwater data from well 1349MW103 demonstrate that soil has not impacted groundwater in the area.

4.6.3 Telecommunications Corridor Soil RU

The recommended alternative for the Telecommunications Corridor Soil RU is the Excavation and Off-site Disposal Alternative.

Under the recommended alternative, the telecommunications conduit will be temporarily rerouted and soil contaminated with petroleum products at concentrations above the cleanup levels will be excavated to the maximum depth possible with conventional equipment (assumed to be approximately 16 feet bgs). Excavated soil will be sampled for waste characterization parameters then transported and disposed of at an off-site permitted waste management facility. The excavation activities will continue until soil confirmation sampling results indicate that cleanup levels for the soil COCs specified in Table 3-1 are met according to the soil confirmation sampling program detailed in Section 5.2. The excavation will be backfilled with clean fill and covered with appropriate topsoil and vegetation in accordance with the VMP (Trust and NPS, 2001).

Monitoring well 1349MW100 may need to be abandoned to accommodate excavation activities. Although not located within the limits of the RU as shown on Figure 3-1, excavation sidewall sloping and over-excavation may be required to access deeper impacted soils within the RU. It is recognized that well 1349MW100 is located within an area that has been previously excavated and subsequently backfilled with clean sand and controlled density fill. While the controlled density fill may provide some inherent slope stability during excavation activities, the thickness of the controlled density fill increases to the west of the RU, as shown on Figures 3-1 and 2-6). Due to excavation depths required at this RU, sloughing of fill and native materials underlying the controlled density fill may jeopardize the integrity of well 1349MW100. In addition, staging of excavation equipment is more feasible on Washington Boulevard due to the natural slope that occurs to the west of the telecommunications conduit that could impede the safe operation of heavy equipment. Although protective measures will be taken, the integrity of well 1349MW100 may be compromised due to heavy equipment traffic. If well 1349MW100 requires abandonment, replacement well 1349MW100R will be

installed. As a conservative measure, this worst-case scenario was assumed for further discussion and included for cost estimating purposes.

It is noted that if bedrock conditions preclude excavation of all impacted soil within the Telecommunications Corridor Soil RU (i.e. unable to excavate relatively more competent bedrock), the contamination will be left in-place and groundwater monitoring will be conducted to address impacts in the vicinity of well 1349MW100 (evaluated under the Groundwater RU).

4.6.4 Groundwater RU

The recommended alternative for the Groundwater RU is the Groundwater Monitoring Alternative.

Groundwater monitoring will effectively demonstrate if observed concentrations of TPHg and TPHd, VOCs, PAHs, OCPs, and arsenic, as well as other metals, are decreasing or stabilized at well 1349MW100. Groundwater Monitoring will also adequately demonstrate if the groundwater plume is limited to the area around well 1349MW100 and if the selected soil remedies have a positive effect on the dissolved-phase concentrations.

To monitor groundwater quality in the vicinity of the Groundwater RU, the following wells will be monitored for a period of up to 5 years:

- Existing wells: 1349MW01, 1349MW02, 1349MW03R, 1349MW100 (prior to replacement and after as replacement well 1349MW100R), 1349MW101, 1349MW102, 1349MW103 (prior to replacement and after as replacement well 1349MW103R), 1349MW104, 1349MW105; and

- Two newly-installed groundwater monitoring wells to be located approximately to the west and north of 1349MW100 (replacement well 1349MW100R).

Wells1349MW100 and -103 will be removed during excavations but will be re-installed following soil excavation activities. Monitoring of wells 1349MW100 and -103 will be conducted prior to excavations. Monitoring of wells 1349MW100R and -103R will commence following backfilling and site restoration.

The two newly installed wells will be placed 1) north of existing well 1349MW100 in the immediate vicinity of the former fuel dispensing station and 2) west of Washington Boulevard, adjacent to the current well 1349MW100 location. Recognizing that groundwater flow is anisotropic, the selection of these two monitoring locations will allow for a better understanding of the complex hydrogeologic conditions that exist at the Study Area and provide verification that groundwater flow in this location is to the west/southwest. The placement of the new wells will also better define the nature and extent of COCs identified at well 1349MW100, as well as the potential relationship with the sporadic detections of OCPs in samples collected from wells located to the west of well 1349MW100.

The Five-Year Status Report, which is required under the RWQCB Order No. R2-2003-0080, will demonstrate the effectiveness of the remedy. This is further discussed in Section 5.3.

5. Implementation of the Preferred Alternatives

This section discusses how the preferred CAP remedies will be implemented including confirmation sampling and groundwater monitoring, LUCs, LTTD soil tracking and management, FDS closure, applicable laws and regulatory requirements, and schedule. Figure 5-1 provides an expanded summary of the preferred alternatives for the Shallow Soil (Areas 1-3), Deep Soil, and Telecommunications Corridor RUs. Figure 5-1, in conjunction with Figures 2-4 through 2-6, provide the locations of those samples with concentrations of COCs in excess of the cleanup levels. In most cases, the vertical and horizontal extents of the various RUs have been estimated based on the spatial distribution of available data, indicating locations of samples where exceedances of the soil cleanup levels had or had not been observed, as discussed in Section 3.3. The limits of some RUs, however, are not well defined with sample data. Implementation of the preferred remedy for each RU will effectively address these data gaps (i.e. post-excavation soil confirmation sampling to define the extents of the soil RUs and groundwater monitoring to address extent of groundwater impacts).

5.1 Remedy Implementation

The corrective actions set forth in Section 4.6.1 for the Shallow Soil RU, Section 4.6.2 for the Deep Soil RU, Section 4.6.3 for the Telecommunications Corridor RU, and Section 4.6.4 for the Groundwater RU will be implemented by the Trust. Upon regulatory agency approval of the Final CAP, a separate implementation Work Plan (called CAP Work Plan) will be prepared for the soil RUs (i.e., Shallow, Deep, and Telecommunications Corridor). Implementation of the Groundwater RU will be made through any necessary modifications to the existing Presidio-Wide Groundwater Monitoring Program specific to the Study Area. In addition, in accordance with the Trust LUCMRR for Area B, the Trust will prepare appropriate documentation for LUCs, as applicable, for any contamination left in-place at the Study Area at concentrations exceeding cleanup levels based on protection of human health or ecological receptors.

5.2 Soil Confirmation Sampling Program

The confirmation soil sampling program for the soil RUs will be detailed in the CAP Work Plan. It is anticipated that after the impacted materials are removed from each excavation, the exposed land surface will consist of an excavation "bottom" with the perimeter of the excavation having "sidewalls." The collection and analysis of confirmation soil samples will determine if the preferred remedy has been effective (i.e., soils in excess of the cleanup levels have been removed).

Bottom sampling will be based on the estimated size of the excavation, with a minimum of one sample per excavation and at least one per 625 sf. A 25- by 25-foot sampling grid will be used to guide the collection of excavation bottom samples.

Each sidewall will be sampled every 50 feet of its lateral extent and at the midpoint of each vertical depth interval range (i.e., one sample at the midpoint of the 0 to 3 feet bgs interval, one sample at the midpoint of the 3 to 10 feet bgs interval, one sample at the midpoint of the greater than 10 feet bgs and >5 feet above groundwater interval, and one sample at the midpoint of the greater than 10 feet bgs and <5 feet above groundwater interval).

The actual physical dimensions of each excavation will determine the number of bottom and sidewall samples collected. All confirmation samples for the excavations within the Study Area will be analyzed for the following COC constituents:

- PAHs by United States Environmental Protection Agency (USEPA) Method 8270C; and

- TPHg, TPHd and/or TPHfo by USEPA Method 8015 modified and USEPA Method 3630A - Silica Gel Cleanup.

In addition, soil confirmation samples from the Shallow Soil RU Area 3 and the Telecommunications Corridor RU will be analyzed for OCPs by USEPA Method 8081 because these constituents are COCs for the groundwater RU but have not been previously tested in soil at the Study Area.

As detailed in Table 3-1, depth-specific cleanup levels (i.e., 0 to 3 feet bgs, 3 to 10 feet bgs, and greater than 10 feet bgs and within or not within 5 feet of groundwater) will be used for soil excavations within the Study Area. The soil confirmation data will be compared with the cleanup levels in Table 3-1 to assess if further excavation is necessary. If all concentrations are below the cleanup levels, the excavation activities will be terminated. If a particular confirmation sample has one or more chemical concentrations from the COC analytical suite exceeding soil cleanup level(s), the contamination will be assessed, based on field observations (e.g., visual contamination, odors, etc.), to determine if it is related to a site-specific release. If the contamination appears to be related to a site-specific release, further soil will be excavated in the area where levels remain elevated and the newly excavated area will be resampled. If the contamination does not appear to be related to a site-specific release, either:

- Further soil will be excavated in the area where levels remain elevated and the newly excavated area will be resampled; or

- No further excavation will be conducted if it can be demonstrated that the residual contamination does not pose a risk to human health or the environment (based on a 95%UCL concentration).

Any over-excavations will continue vertically and/or laterally in 1.0-ft increments. The RWQCB will be consulted regarding further excavation decisions. When it is determined that a soil RU no longer poses a risk to human health or the environment and RWQCB concurs with the assessment, the excavation will be considered complete. If cleanup levels cannot be achieved due to technical considerations (such as the inability to effectively excavate weathered bedrock), the soil removal program will be terminated and LUC(s) will be adopted, as necessary, in accordance with Section 5.4 below.

5.3 Groundwater Monitoring Program

The recommended remedial alternative for the Groundwater RU is Groundwater Monitoring. Groundwater monitoring will effectively determine if observed concentrations of TPHg and TPHd, VOCs, PAHs, and OCPs are decreasing or stabilized at well 1349MW100. Groundwater Monitoring will also effectively demonstrate if the groundwater plume is limited to the area around well 1349MW100.

To monitor groundwater quality in the vicinity of the Groundwater RU, the following wells will be monitored:

- Existing wells: 1349MW01, 1349MW02, 1349MW03R, 1349MW100 (prior to replacement and after as replacement well 1349MW100R), 1349MW101, 1349MW102, 1349MW103 (prior to replacement and after as replacement well 1349MW103R), 1349MW104, 1349MW105; and

- Two newly-installed groundwater monitoring wells to be located approximately to the west and north of 1349MW100 (replacement well 1349MW100R).

Wells 1349MW100 and -103 will be removed during excavations but replacement wells 1349MW100R and -103R will be re-installed following soil excavation activities. Monitoring of wells 1349MW100 and -103 will be conducted prior to excavation. Monitoring of wells 1349MW100R and -103R will commence following backfilling and site restoration.

The two newly installed wells will be placed 1) north of existing well 1349MW100 in the immediate vicinity of the former fuel dispensing station and 2) west of Washington Boulevard, adjacent to the current well 1349MW100 location. Recognizing that groundwater flow is anisotropic, the selection of these two monitoring locations will allow for a better understanding of the complex hydrogeologic conditions that exist at the Study Area and provide verification that groundwater flow in this location is to the west/southwest. The placement of the new wells will also better define the nature and extent of COCs identified at well 1349MW100, as well as the potential relationship with the sporadic detections of OCPs in samples collected from wells located to the west of well 1349MW100.

Groundwater monitoring will be conducted for a period of up to 5 years. The depth to groundwater will be measured and groundwater elevations calculated during each sampling event. Groundwater samples, including quality assurance/quality control (QA/QC) samples (duplicates, equipment blanks, and trip blanks), will be collected and analyzed, in accordance with the QAPP (Tetra Tech, 2001) for the following analytes (listed in Table 5-2).

- PAHs by USEPA Method 8270C;

- TPHg, TPHd and/or TPHfo by USEPA Method 8015 modified;

- VOCs by USEPA Method 8260B;

- OCPs by USEPA Method 8081;

- Dissolved metals by USEPA Method 6010; and

- General chemistry parameters.

The groundwater cleanup levels for these constituents are presented in Table 3-2. Groundwater will be analyzed quarterly for a minimum of 2 years for all constituents identified above (for a total of 8 sampling events). If all constituents within an analytical suite have concentrations below cleanup levels for four consecutive quarterly sampling events, then the frequency of monitoring for the analytical suite will be reduced to a semi-annual basis. If after an additional year of semi-annual sampling, all constituents within the analytical suite have concentrations below cleanup levels, the analytical suite will no longer be analyzed in groundwater samples. Similarly, if all analyzed constituents at an individual well have concentrations below cleanup levels for four consecutive quarterly sampling events, then the frequency of monitoring for the well will be reduced to a semi-

annual basis. If after an additional year of semi-annual sampling of the well, all constituents within the well have concentrations below cleanup levels, the well will no longer be sampled. If all analytical suites and groundwater wells meet these criteria within a 5-year monitoring period, the groundwater monitoring program will be discontinued and the wells will be considered for abandonment at that time.

In accordance with Task 13 of RWQCB Order R2-2003-0080, a Five-Year Status Report, which evaluates the effectiveness of this CAP for groundwater, will be completed and submitted to the RWQCB for approval. In the Five-Year Status Report, groundwater conditions within the Study Area will be evaluated and future corrective actions will be assessed based on the following general criteria:

- If cleanup levels for all analyzed constituents are achieved within the 5-year monitoring period as described above, the groundwater monitoring program will be discontinued;

- If it is demonstrated that constituent concentrations are moving towards cleanup levels (i.e., showing a consistent decreasing trend) within a reasonable time period, the groundwater monitoring program will either be discontinued or continued for a specified time period to confirm attainment of cleanup levels, as appropriate;

- If constituent concentration(s) are above cleanup levels but have remained generally stable (i.e., no increasing trend) and the groundwater impacts are shown to be localized around well 1349MW100, restrictions on use of groundwater in the area may be implemented, as appropriate, based on an updated evaluation of performance data, cost-effectiveness, current remedial technologies, probability of potential groundwater development, etc. as required by Task 13 of the Order; and

- If constituent concentrations(s) are above cleanup levels and not generally stable (i.e., increasing trend) or a larger groundwater plume (beyond the general vicinity of well 1349MW100) is identified, an alternative cleanup strategy for the Groundwater RU will be evaluated.

It is noted that metals data in groundwater, including total chromium, arsenic, and nickel, will be evaluated in the context of cleanup levels, but also to evaluate geochemical conditions at the Study Area. As discussed in Appendix E and Section 2.5.2, dissolved metals concentrations in groundwater above cleanup levels are considered to be related to the geochemical environment of the Study Area. The presence of dissolved metals is related to the complex geochemical interactions that occur as a result of naturally occurring conditions and those conditions affected by the degradation of petroleum hydrocarbons. As discussed in Appendix E, the fate and transport of observed dissolved metals concentrations are limited under worst case conditions and are expected to be even more limited as degradation of petroleum hydrocarbons becomes complete. The Five-Year Status Report will evaluate current geochemical conditions and trends to assess if metals concentrations above cleanup levels in groundwater can remain with no further action. In addition, the evaluation of dissolved metals data as well as general chemistry parameters will help determine if observed existing natural degradation processes continue to occur over time which will further demonstrate the effectiveness of the preferred alternative.

5.4 Land Use Controls

As discussed in Section 5.2, the preferred remedy for all soil remedial units is excavation and off-site disposal. However, it is possible that soil with constituent concentrations exceeding cleanup levels may be left in-place following soil removal due to technical limitations (such as the inability to effectively excavate weathered bedrock). This is particularly likely for the Deep Soil RU and the Telecommunications RU, which contain deep soil (below 10 feet bgs) with chemical concentrations exceeding cleanup levels. LUC(s) may need to be

adopted for contamination left in-place, depending on whether the contamination falls within the 0 to 10 feet bgs or greater than 10 feet bgs depth intervals.

The cleanup criteria for soils below 10 feet bgs were selected based on protection of groundwater. If soils with constituent concentrations are left in-place below 10 feet bgs, no LUCs will be adopted as there is no exposure for humans and ecological receptors at this depth interval. As detailed in Section 5.3, groundwater monitoring will be conducted at the Study Area to address potential impacts to groundwater.

If soils with constituent concentrations are left in-place following soil excavations within the 0 to 10 feet bgs depth interval, LUC(s) will be adopted to protect human health and the environment. The LUC is a non-engineering measure designed to limit exposure to the contaminants left in place in soil above levels considered protective for specific use(s) of a site. The LUC prohibits specific use(s) of a site and notifies present or future owners and tenants at the site of the potential presence of contaminants remaining in soil at concentrations that may not be protective of unrestricted future site use. The LUC requirements and restrictions are binding on current or subsequent property owners and remain in effect until they are formally removed or modified.

Residential human health and ecological special-status cleanup levels were selected as cleanup criteria in soil from 0 to 10 feet bgs and 0 to 3 feet bgs, respectively, to allow unrestricted future site use. Therefore, although current and planned land use at the Building 1349 Area is recreational with special-status ecological species potentially present (EKI, 2002), non-attainment of cleanup levels provided in this CAP will require LUCs to restrict unlimited site use.

The goals of the LUC would be as follows:

- Prevent inappropriate land use of the property containing residual contamination in soil;
- Assure that information about the property containing residual contamination in soil is available to the public (via the LUCMRR);
- Ensure that long-term mitigation measures and monitoring requirements are carried out and maintained (as described below);
- Ensure that the integrity and stability of the remedy is maintained;
- Ensure that subsequent property owners or transferees have a duty to assume any responsibility for requirements or restrictions pertaining to the residual contamination in soil when the property is transferred; and
- Ensure that the RWQCB would be contacted prior to a change in land use or the selected remedy.

The procedures below would be followed to ensure that the specified LUC(s) for the Study Area are adhered to by present and future owners and users of the property:

- Project Permit Process – In advance of implementation, all Presidio plans and projects must be screened for compliance with the National Environmental Policy Act (NEPA) and the National Historic Preservation Act (NHPA). The Trust would use its interdisciplinary NEPA/NHPA environmental screening process to notify planning/project proponents of the LUC. In addition, for any project involving excavation or subsurface intrusion within an "LUC Zone," the Trust must approve a "dig permit" to ensure that subsurface utilities (e.g., water, gas, sewer, fiber optic) are not damaged. The

Trust would also use its Excavation Clearance Permit process to notify and require adherence by excavation project proponents of the LUC restrictions and requirements.

- LUC Master Reference Report – The LUC Zone(s) at the Study Area would be included in the Trust's LUCMRR. The LUCMRR, which includes a master map showing all Presidio-wide LUC Zones and a compilation of all Presidio LUC requirements and restrictions, is maintained and kept current at the Trust Library. Planning/project proponents and other members of the public may review all existing LUCs for the Presidio by reviewing the LUCMRR in the Trust Library.

- Notification and Annual Monitoring – The Trust would notify the RWQCB regarding any proposed land use plan or project that may be inconsistent with the LUC, any proposed action that may disrupt the effectiveness of the LUC, and any proposed action that could alter or eliminate the continued need for the LUC. The Trust submits an annual Presidio LUC Report to confirm that human land uses within Presidio LUCs Zones are consistent with the restrictions and requirements specified herein.

- Transfer of Ownership or Control – The Trust would notify the RWQCB of any anticipated transfer of ownership or control of any portion of the LUC Zone(s) for the Study Area. In the event of a transfer of ownership or control of an LUC Zone, in whole or in part, the Trust would record the Presidio's LUCMRR with the City and County of San Francisco Recorder's Office and the Federal General Services Agency (GSA) to place subsequent Presidio owners or managers on notice of the existence of the LUC Zone(s). As part of the administrative transfer of the property, the Trust would notify the subsequent owner or manager of the duty to comply with the LUC and provide a complete copy of the LUCMRR.

5.5 LTTD Soil Tracking and Management

LTTD soils previously used as backfill within the FDS trench and remedial excavations (Figure 5-1) will be managed and tracked in accordance with the LTTD Soil Tracking and Management Plan (EKI, 2004). LTTD soils are expected to be encountered and removed during excavation of the Shallow Soil RU Area 1. Notification for the presence of LTTD soils will be addressed in the Trust's "dig permit" prior to excavation activities. If the LTTD soils are stockpiled onsite, they will be segregated and stockpiled separately from non-LTTD soil. The LTTD soils will be disposed off-site at a permitted treatment and/or disposal facility in accordance with applicable laws and regulations. Tracking and management of the LTTD soils by the Trust will no longer be applicable once the soils are removed and disposed off-site.

LTTD soils also extend beyond the assumed limits for Shallow Soil RU Area 1 (Figure 5-1). The Trust may opt to either excavate these LTTD soils as part of the CAP excavations to eliminate the necessity of tracking the soils or leave the LTTD soils in-place. No sampling will be required to leave these LTTD soils in-place, as previous sampling has indicated that TPH and PAH concentrations meet the SCRs from Order No. R2-2003-0080 (RWQCB, 2003a; Section 2.4.3). Soils remaining in-place will be retained in the Trust's geographical information system (GIS) database for tracking of LTTD soils. Appropriate personnel will be notified prior to any future construction, maintenance, or other subsurface operations conducted in the area so that restrictions and requirements for the LTTD soils identified in the LTTD Soil Tracking and Management Plan (EKI, 2004), such as restrictions on removal, relocation, and reuse, are followed.

5.6 Closure of FDS

Upon completion of the corrective actions selected in this CAP for the Study Area, the portions of the former FDS pipelines within the Study Area will be considered closed in accordance with RWQCB Order R2-2003-0080 (RWQCB, 2003a). The portions of the FDS pipelines within the Study Area extend from the general vicinity of the former AST northwards to Kobbe Avenue, eastwards to Harrison Boulevard, and southwards to the limits of the former Fill Site 5. Per Task 12 of the RWQCB Order, the CAP Closure Report will include confirmation soil sampling results for the former FDS pipeline trenches and excavations to demonstrate compliance with the cleanup levels specified in Table 3-1 of this CAP.

5.7 Applicable State and Federal Laws and Regulatory Requirements

Implementation of the selected corrective action alternatives will comply with applicable state and federal laws and regulations including the requirements of Title 23, Division 3, Chapter 16, Article 11, which are the primary regulations establishing the requirements and standards for petroleum-related corrective action in the State of California. The alternatives selected by this CAP will also comply with applicable laws and regulations regarding management and disposal of excavated soil, including transport to and treatment at regulated and permitted facilities. As detailed in the RWQCB Order No. R2-2003-0080, the Study Area is a known petroleum contamination site requiring preparation and implementation of this CAP to meet the requirements of 23 CCR § 2725. The RWQCB Order No. R2-2003-0080 presents cleanup standards as SCRs for the protection of human health, ecological receptors, and water quality, which were used to set the applicable CAP cleanup levels.

The Presidio as a whole is within the GGNRA and is listed in the National Register of Historic Places as a Historic Landmark, which affords its historic resources and cultural landscapes certain protection under the NHPA. The Trust Programmatic Agreement, which sets forth the procedures to implement the historic compliance process of Section 106 of the NHPA for Area B, will be followed. In addition, archeological sites and resources are known to exist or may be discovered within the Presidio. During corrective action implementation, the Trust will comply with applicable provisions of the Archeological and Historic Preservation Act (AHPA) and the Native American Graves Protection and Repatriation Act (NAGPRA) if such resources are encountered during implementation work concerning this CAP. Other federal and state statutes, such as the federal and state Endangered Species Acts (ESA and CESA) and the Migratory Bird Treaty Act (MBTA) also provide standards for protection of natural resources found on the Presidio that will be followed during this corrective action.

Since the Study Area is within Area B of the Presidio, the corrective action will be completed in a manner consistent with land uses established by the PTMP. NPS Management Policies and the Presidio VMP (Trust and NPS, 2001) apply to the corrective action work.

With regard to soil excavation and disposal, state laws and regulations implement the federal Resource Conservation and Recovery Act (RCRA) standards and are applicable to the corrective actions at the Study Area. These provisions include standards for properly storing, handling, and transporting excavated soils that may contain hazardous constituents. These regulations also set standards for testing of potential hazardous wastes prior to management and proper off-site disposal.

The impacted soil at the Study Area is not believed to be hazardous waste. The transport and disposal of non-hazardous waste that may be generated during the corrective action will be performed in accordance with the pertinent sections of Title 27 of the CCR, which addresses the proper management of solid wastes.

The corrective actions at the Study Area consider the RWQCB Basin Plan policy of no loss of wetlands, as well as Presidio wetlands resources (NPS and Trust, 2003). Any applicable discharge prohibitions and erosion control measures will protect surface water and wetland resources.

Also, Bay Area Air Quality Management District (BAAQMD) regulations pertinent to dust suppression and onsite air monitoring during excavation work will be met to prevent air quality impacts from the selected remedial actions. BAAQMD regulations under the Clean Air Act pertaining to remediation activities in areas of serpentinite rocks and soil will be followed. A dust mitigation plan for on-site dust mitigation and monitoring for asbestos will be prepared in accordance with the Air Resources Board Model Rule. Although not anticipated to be present, if unknown underground storage tanks (USTs) are found during remedial activities, removal will comply with applicable state and local requirements.

5.8 Implementation Schedule

Upon final regulatory approval by the RWQCB of the Final CAP, all deliverables and corrective actions authorized by the CAP will be prepared and implemented according to the schedule, as amended, required by the RWQCB Order. The RWQCB Order schedule currently requires that remedy construction at the Study Area begin by February 28, 2006.

Upon regulatory agency approval of the Final CAP, the CAP Work Plan for application of the preferred alternatives for the soil RUs will be prepared. Once the CAP Work Plan is approved by the RWQCB, the CAP will be implemented. As required by the RWQCB Order No. R2-2003-0080, a report documenting implementation of the soil corrective actions, construction completion, and groundwater monitoring results will be issued on or before January 30, 2007. In accordance with Task 13 of RWQCB Order No. R2-2003-0080, a Five-Year Status Report, which evaluates the effectiveness of the CAP for groundwater, will be issued in 5 years following implementation of this CAP.

6. References

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Tables

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

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Table 2-1
Summary of Groundwater Elevations
Building 1349 Area
Presidio of San Francisco, California

Well ID	Date	Average Depth to Water [1] (feet)	Top of Casing Elevation (feet PLLW)	Groundwater Elevation (feet PLLW)	Well Type
1349MW01	05/24/04	27.78	300.44	272.66	MW
	03/08/04	26.84	300.44	273.60	MW
	12/01/03	29.38	300.44	271.06	MW
	08/11/03	27.91	300.44	272.53	MW
	06/02/03	28.33	300.44	272.11	MW
	03/10/03	28.19	300.44	272.25	MW
	12/02/02	29.61	300.44	270.83	MW
	08/26/02	28.69	300.44	271.75	MW
	05/28/02	28.38	300.44	272.06	MW
	03/04/02	27.70	300.44	272.74	MW
	11/26/01	29.76	300.44	270.68	MW
	08/27/01	30.17	300.44	270.27	MW
	05/08/01	29.45	300.44	270.99	MW
1349MW02	05/24/04	34.20	311.22	277.02	MW
	03/08/04	34.14	311.22	277.08	MW
	12/01/03	36.66	311.22	274.56	MW
	08/11/03	35.46	311.22	275.76	MW
	06/02/03	35.03	311.22	276.19	MW
	03/10/03	35.46	311.22	275.76	MW
	12/02/02	36.98	311.22	274.24	MW
	08/26/02	35.94	311.22	275.28	MW
	05/28/02	34.95	311.22	276.27	MW
	03/04/02	35.54	311.22	275.68	MW
	11/26/01	37.75	311.22	273.47	MW
	08/27/01	36.79	311.22	274.43	MW
	05/08/01	35.47	311.22	275.75	MW
1349MW03	08/26/02	28.63	300.54	271.91	MW
	05/28/02	26.64	300.54	273.90	MW
	03/04/02	25.20	300.54	275.34	MW
	11/26/01	30.67	300.54	269.87	MW
	08/27/01	29.65	300.54	270.89	MW
	05/08/01	26.56	300.54	273.98	MW
1349MW03R	05/24/04	29.40	304.13	274.73	MW
	03/08/04	28.43	304.13	275.70	MW
	12/01/03	33.33	304.13	270.80	MW
	08/11/03	31.69	304.13	272.44	MW
	06/02/03	30.48	304.13	273.65	MW
1349MW100	05/24/04	32.05	309.60	277.55	MW
	03/08/04	31.63	309.60	277.97	MW
	12/01/03	34.42	309.60	275.18	MW
	08/11/03	32.98	309.60	276.62	MW
	06/02/03	32.75	309.60	276.85	MW
	03/10/03	33.30	309.60	276.30	MW
	12/02/02	34.67	309.60	274.93	MW

Table 2-1
Summary of Groundwater Elevations
Building 1349 Area
Presidio of San Francisco, California

Well ID	Date	Average Depth to Water [1] (feet)	Top of Casing Elevation (feet PLLW)	Groundwater Elevation (feet PLLW)	Well Type
1349MW101	05/24/04	32.23	311.63	279.40	MW
	03/08/04	32.90	311.63	278.73	MW
	12/01/03	35.25	311.63	276.38	MW
	08/11/03	34.14	311.63	277.49	MW
	06/02/03	33.59	311.63	278.04	MW
1349MW102	05/24/04	25.68	305.68	280.00	MW
	03/08/04	25.62	305.68	280.06	MW
	12/01/03	28.17	305.68	277.51	MW
	08/11/03	26.96	305.68	278.72	MW
	06/02/03	26.51	305.68	279.17	MW
1349MW103	05/24/04	38.40	318.07	279.67	MW
	03/08/04	38.75	318.07	279.32	MW
	12/01/03	40.69	318.07	277.38	MW
	08/11/03	39.51	318.07	278.56	MW
	06/02/03	39.33	318.07	278.74	MW
1349MW104	05/24/04	35.18	314.58	279.40	MW
	03/08/04	35.76	314.58	278.82	MW
	12/01/03	37.43	314.58	277.15	MW
	08/11/03	36.27	314.58	278.31	MW
	06/02/03	35.96	314.58	278.62	MW
1349MW105	05/24/04	33.20	312.05	278.85	MW
	03/08/04	33.71	312.05	278.34	MW
	12/01/03	34.38	312.05	277.67	MW
	08/11/03	33.77	312.05	278.28	MW
	06/02/03	34.20	312.05	277.85	MW
LF5GW100	5/24/2004	9.05	229.74	220.69	MW
	3/8/2004	9.1	229.74	220.64	MW
	12/1/2003	9.3	229.74	220.44	MW
	8/11/2003	6.71	229.74	223.03	MW
	6/2/2003	6.98	229.74	222.76	MW
	3/10/2003	9.1	229.74	220.64	MW
	12/2/2002	7.17	229.74	222.57	MW
LF5GW100	8/26/2002	5.05	229.74	224.69	MW
	5/28/2002	6.31	229.74	223.43	MW
	3/4/2002	5.25	229.74	224.49	MW
	11/26/2001	6.73	229.74	223.01	MW
	8/27/2001	11.09	229.74	218.65	MW
	5/8/2001	6.32	229.74	223.42	MW

Table 2-1
Summary of Groundwater Elevations
Building 1349 Area
Presidio of San Francisco, California

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Well ID	Date	Average Depth to Water [1] (feet)	Top of Casing Elevation (feet PLLW)	Groundwater Elevation (feet PLLW)	Well Type
LF5GW101	5/24/2004	4.95	234.36	229.41	MW
	3/8/2004	3.97	234.36	230.39	MW
	12/1/2003	5.15	234.36	229.21	MW
	8/11/2003	5.95	234.36	228.41	MW
	6/2/2003	5.78	234.36	228.58	MW
	3/10/2003	6.85	234.36	227.51	MW
	12/2/2002	9.19	234.36	225.17	MW
	8/26/2002	5.84	234.36	228.52	MW
	5/28/2002	8.65	234.36	225.71	MW
	3/4/2002	6.77	234.36	227.59	MW
	11/26/2001	8.38	234.36	225.98	MW
	8/27/2001	6.66	234.36	227.7	MW
	5/8/2001	2	234.36	232.36	MW
LF5GW102	5/24/2004	29.67	294.76	265.09	MW
	3/8/2004	30.51	294.76	264.25	MW
	12/1/2003	31.23	294.76	263.53	MW
	8/11/2003	30.75	294.76	264.01	MW
	6/2/2003	29.35	294.76	265.41	MW
LF5GW103	5/4/2004	13.31	279.12	265.81	MW
	3/8/2004	13.47	279.12	265.65	MW
	12/1/2003	14.31	279.12	264.81	MW
	8/11/2003	13.45	279.12	265.67	MW
	6/2/2003	12.33	279.12	266.79	MW
LF5GW104	5/24/2004	25.45	286.05	260.6	MW
	3/8/2004	20.89	286.05	265.16	MW
	12/1/2003	27.06	286.05	258.99	MW
	8/11/2003	25.35	286.05	260.7	MW
	6/2/2003	23.44	286.05	262.61	MW

Notes
1 - All depth to water measurements are an average of three measurements recorded in the field.
MW - Monitoring well
feet PLLW - feet above Presidio lower low water vertical datum

Table 2-2
Summary of Previous Site Investigation and Corrective Actions
Building 1349 Area
Presidio of San Francisco, CA

Investigation Report	Date/Performed By	Summary of Activity	Potential Contaminants of Concern
Final Building 1349 Site Investigation	January 1995/Montgomery Watson	Site investigation conducted in two phases at the Site. Phase 1: Fourteen soil borings were advanced in August 1993. • One grab groundwater sample and 51 soil samples were collected for TPHd, BTEX, and metals. • Analytical results indicated high soil concentrations of TPHd in the area of the former drainage gully, east of Washington Boulevard. Phase 2: Eight soil borings were advanced in February 1994. • Thirty-seven soil samples and one groundwater sample were collected for TPHd and BTEX analyses. • Analytical results indicated high soil concentrations of TPHd in the area of the former drainage gully, east of Washington Boulevard and groundwater. • Select soil samples were analyzed for physical and biological parameters to help assess potential soil remediation technologies. • A leaking, shallow underground fuel pipe between the tank and fuel dispensing structure was located and identified as a potential source area. • High-resolution seismic reflection study indicated up to eight bedrock lineaments at the site.	TPHd
Final Building 1349 Additional Site Investigation	May 1996/Montgomery Watson	Phase 3: Nine soil borings were advanced to depths ranging from approximately 38 to 58 feet below ground surface (bgs). • Relatively low concentrations of TPHd were detected from 0 to 30 feet bgs with concentrations ranging from 1.0 to 7.7 mg/kg, and increasing concentrations of TPHd were observed in soil from 30 to 50 feet bgs ranging from 330 to 990 mg/kg.	TPHd

Table 2-2
Summary of Previous Site Investigation and Corrective Actions
Building 1349 Area
Presidio of San Francisco, CA

Investigation Report	Date/Performed By	Summary of Activity	Potential Contaminants of Concern
		• TPHd was detected in three grab groundwater samples at concentrations of 1,300 ppb, 24,000 ppb, and 4,700 ppb. Concentrations in groundwater were above the cleanup level of 880 ppb. • Three groundwater monitoring wells were installed in converted soil borings.	
Aboveground Storage Tank Closure	May 1996/IT Corporation	Removal action activities included the removal of Building 1349 and associated piping. In addition, soil was removed from the areas at the site as follows: • **Area 1**: Excavation area of approximately 25 by 35 feet to a depth of 7.0 feet bgs. • **Area 2**: Excavation area of approximately 70 by 25 feet to a depth of 12 feet bgs. • **Area 3**: Excavation area of approximately 40 by 50 feet to a depth of 13.2 feet bgs. Confirmation samples were collected for soil remaining in place. Concentrations of TPHd in soil ranged from 14,000 to 24,000 mg/kg beneath the communications conduit at 3.0 feet bgs. Two additional samples were collected at depths of 4 and 6 feet gbs. TPHd was detected at concentrations of 13,000 and 14,000 mg/kg. Four samples were collected at 12 feet bgs with concentrations of TPHd ranging from 3,200 to 10,000 mg/kg. PAHs were detected at a maximum concentration of 51 mg/kg for naphthalene.	TPHd and PAHs
Fuel Distribution System Closure Report	May 1999/IT Corporation	A portion of the Presidio-wide FDS piping removal corrective action. Two FDS pipeline removal actions, MT-6 and MT-7, occurred in the vicinity of Building 1349 (IT, 1995).	TPHd, TPHfo and PAHs

Table 2-2
Summary of Previous Site Investigation and Corrective Actions
Building 1349 Area
Presidio of San Francisco, CA

Investigation Report	Date/Performed By	Summary of Activity	Potential Contaminants of Concern
		• Approximately 1,000 linear feet of 6-inch pipeline were excavated and removed from the MT-6 area and 2,000 linear feet excavated and removed from MT-7. • Trench excavations were backfilled with overburden soil from the excavations to 18 inches bgs and with imported topsoil from 18 inches bgs to ground surface. Three FDS Remedial Excavations (total of approximately 190 cubic yards) were completed in the area north of Building 1349 at areas overlapping former MT-6 and MT-7 excavations. • Post-excavation confirmation soil samples were collected from the bottoms and sidewalls of the excavations. • Field immunoassay analytical tests were performed on the confirmation samples as well as laboratory confirmation analysis based on the field immunoassay results (IT, 1999). • Immunoassay and laboratory analytical results indicate that soils with TPH and PAHs exceeding the action levels were left in place. • Excavated soils were LTTD-treated and used as backfill.	
Additional Investigation of Fuel Distribution Systems	August 1999/Montgomery Watson	Investigation of former FDS pipeline trending south from Building 1349 across Washington Blvd. • Soil borings advanced at 100-foot intervals along former pipeline. • TPHfo not detected above 115 mg/kg. • Decision document indicating “no further action” recommended.	None
Draft Building 1349 Site Investigation Report	October 2003/Treadwell & Rollo	Soil and groundwater data gap assessment. Total of 31 soil borings advanced to various depths. • Soil and grab groundwater samples analyzed for TPHd, TPHfo and PAHs. • Shallow soil samples collected at 2.5 feet bgs to 7.5 feet bgs from nine borings from the former FDS remedial excavations and FDS	TPHd, TPHfo, PAHs and OCPs (OCPs in groundwater only)

Table 2-2
Summary of Previous Site Investigation and Corrective Actions
Building 1349 Area
Presidio of San Francisco, CA

Investigation Report	Date/Performed By	Summary of Activity	Potential Contaminants of Concern
		trench excavations contained TPHd, TPHfo and several PAH concentrations above their respective cleanup levels. • Deep soil samples collected at 12 feet bgs and 20 feet bgs from 1349SB127 at former FDS remedial excavation contained TPHd at 17,000 mg/kg and naphthalene at 17 mg/kg. • TPHd exceedances of cleanup levels detected in grab groundwater samples collected from borings 1349SB103, 1349SB108 and 1349SB111. Seven monitoring wells installed at the site (1349MW100 through 1349MW105), including replacement well 1349MW03R. • Wells included in quarterly Presidio-wide groundwater monitoring network. • TPHd and PAHs detected at 1349MW100 above their respective cleanup levels. • Several OCPs detected at concentrations above screening levels at 1349MW100; most data qualified or of apparent low quality. • PAHs detected in excess of cleanup goals once at 1349MW03 during Fourth Quarter 2001.	

Notes: BTEX - benzene, toluene, ethylene, and xylenes
FDS - Fuel Distribution System
mg/kg - milligrams per kilogram
PAHs - polycyclic aromatic hydrocarbons
µg/L - micrograms per liter
µg/kg – micrograms per kilogram
TPHd - total petroleum hydrocarbons as diesel
TPHfo - total petroleum hydrocarbons as fuel oil (using a motor oil standard with carbon range C24-C36)
TPHg - total petroleum hydrocarbons as gasoline.
VOCs - volatile organic compounds
OCPs – Organochlorine Pesticides
LTTD – Low Temperature Thermal Desorption

Table 3-1
Summary of Soil Cleanup Levels
Building 1349 Area
Presidio of San Francisco, California

Chemical	Protection of Human Health Recreational Cleanup Level [a]	Protection of Human Health Residential Cleanup Level [a,b,d]	Protection of Ecological Receptors Cleanup Level for Terrestrial Receptors [a]	Protection of Ecological Receptors Cleanup Level for Special-Status Receptors [a]	Background Metals Concentrations for Serpentinite Soil [f]	Protection of Groundwater Resources Cleanup Level for Soil to Maintain Drinking Water Standard in Groundwater Soil Less Than 5 feet Above Groundwater [a]	Protection of Groundwater Resources Cleanup Level for Soil to Maintain Drinking Water Standard in Groundwater Soil Greater Than 5 feet Above Groundwater [a]	QAPP Analytical Reporting Limit	Laboratory Detection Limit	Effective Soil Cleanup Level Soil 0 to 3 feet bgs [c]	Effective Soil Cleanup Level Soil 3 to 10 feet bgs [d]	Effective Soil Cleanup Level Soil Greater Than 10 feet bgs and Less Than 5 feet above groundwater [e]	Effective Soil Cleanup Level Soil Greater Than 10 feet bgs and Greater Than 5 feet above groundwater [e]
Metals (mg/kg) [f]													
Arsenic	0.88	0.36	--	10	5.4	--	--	0.2	0.25	**5.4**	**5.4**	**--**	**--**
Beryllium	350	140	--	10	1.1	--	--	0.1	0.1	**10**	**140**	**--**	**--**
Cadmium	4.2	1.7	--	0.017	1.9	--	--	0.1	0.25	**1.9**	**1.9**	**--**	**--**
Chromium	2,800	1,200	--	4	1,700	--	--	0.2	0.5	**1,700**	**1,700**	**--**	**--**
Copper	--	--	--	30	85	--	--	0.2	0.5	**85**	**--**	**--**	**--**
Iron	--	--	--	--	--	--	--	5.0	10	**--**	**--**	**--**	**--**
Lead	500	400	--	160	66	--	--	0.1	0.25	**160**	**400**	**--**	**--**
Manganese	--	--	--	--	--	--	--	0.1	0.5	**--**	**--**	**--**	**--**
Mercury	52	20	--	0.4	0.2	--	--	0.1	0.02	**0.4**	**20**	**--**	**--**
Nickel	3,500	1,400	--	30	4,500	--	--	0.2	0.25	**4,500**	**4,500**	**--**	**--**
Selenium	870	360	--	0.2	0.5	--	--	0.2	0.25	**0.5**	**360**	**--**	**--**
Vanadium	1,600	650	--	2	74	--	--	1.0	0.25	**74**	**650**	**--**	**--**
Zinc	52,000	22,000	--	4	160	--	--	0.2	1	**160**	**22,000**	**--**	**--**
Organochlorine Pesticides (mg/kg) [h]													
Aldrin	0.07	0.029	--	0.0039	--	--	--	0.002	0.0017	**0.0039**	**0.029**	**--**	**--**
alpha-BHC	0.44	0.18	--	0.062	--	--	--	0.002	0.0017	**0.062**	**0.18**	**--**	**--**
beta -BHC	0.79	0.32	--	0.062	--	--	--	0.002	0.0017	**0.062**	**0.32**	**--**	**--**
delta-BHC	0.44	0.18	--	0.062	--	--	--	0.002	0.0017	**0.062**	**0.18**	**--**	**--**
Chlordane (alpha and gamma)e	0.91	0.37	--	0.009	--	--	--	0.002	0.0017	**0.009**	**0.37**	**--**	**--**
4,4-DDD	4.9	2	--	0.049	--	--	--	0.002	0.0033	**0.049**	**2**	**--**	**--**
4,4-DDE	3.5	1.4	--	0.098	--	--	--	0.004	0.0033	**0.098**	**1.4**	**--**	**--**
4,4-DDT	3.5	1.4	--	0.0082	--	--	--	0.004	0.0033	**0.0082**	**1.4**	**--**	**--**
Dieldrin	0.074	0.03	--	0.039	--	--	--	0.004	0.0033	**0.03**	**0.03**	**--**	**--**
Endosulfan	900	370	--	1.1	--	--	--	0.002	0.0017	**1.1**	**370**	**--**	**--**
Endosulfan sulfate	900	370	--	1.1	--	--	--	0.004	0.0033	**1.1**	**370**	**--**	**--**
Endrin	45	18	--	0.004	--	--	--	0.004	0.0033	**0.004**	**18**	**--**	**--**
Endrin aldehyde	45	18	--	0.004	--	--	--	0.004	0.0033	**0.004**	**18**	**--**	**--**
gamma-BHC	1.1	0.44	--	0.01	--	--	--	0.002	0.0017	**0.01**	**0.44**	**--**	**--**
Heptachlor	0.29	0.12	--	0.017	--	--	--	0.002	0.0017	**0.017**	**0.12**	**--**	**--**
Heptachlor epoxide	0.21	0.088	--	0.017	--	--	--	0.002	0.0017	**0.017**	**0.088**	**--**	**--**
Methoxychlor	750	310	--	0.44	--	--	--	0.02	0.017	**0.44**	**310**	**--**	**--**
Polycyclic Aromatic Hydrocarbons (mg/kg) [g]													
Acenaphthene	6,600 h	2,700 h	--	--	--	--	--	0.33	0.0035	**2,700**	**2,700**	**--**	**--**
Acenaphthylene	--	--	--	--	--	--	--	0.33	0.0035	**--**	**--**	**--**	**--**
Anthracene	13,800	5,900	--	--	--	308	--	0.33	0.0035	**5,900**	**5,900**	**308**	**--**
Benzo(a)anthracene	1	0.43	--	--	--	8	--	0.33	0.0035	**0.43**	**0.43**	**8**	**--**
Benzo(a)pyrene	0.1	0.04	0.3	--	--	3	--	0.33	0.0035	**0.04**	**0.04**	**3**	**--**
Benzo(b)fluoranthene	1	0.43	--	--	--	23	--	0.33	0.0035	**0.43**	**0.43**	**23**	**--**
Benzo(g,h,i)perylene	1,400	620	--	--	--	5,040	--	0.33	0.0035	**620**	**620**	**5,040**	**--**
Benzo(k)fluoranthene	1	0.43	--	--	--	23	--	0.33	0.0035	**0.43**	**0.43**	**23**	**--**
Chrysene	10	4.3	--	--	--	54	--	0.33	0.0035	**4.3**	**4.3**	**54**	**--**
Dibenzo(a,h) anthracene	0.19 h	0.078 h	--	--	--	--	--	0.33	0.0035	**0.078**	**0.078**	**--**	**--**
Fluoranthene	1,900	820	--	--	--	316	--	0.33	0.0035	**820**	**820**	**316**	**--**
Fluorene	1,800	770	--	--	--	60	--	0.33	0.0035	**770**	**770**	**60**	**--**
Indeno(1,2,3-cd)Pyrene	0.65 h	0.27 h	--	--	--	--	--	0.33	0.0035	**0.27**	**0.27**	**--**	**--**
Naphthalene	1,100	480	--	--	--	9	--	0.33	0.0035	**480**	**480**	**9**	**--**
Phenanthrene	1,400	600	--	--	--	86	--	0.33	0.0035	**600**	**600**	**86**	**--**
Total Carcinogenic PAHs	13	5.6	--	--	--	111	--	--	--	**5.6**	**5.6**	**111**	**--**
Pyrene	1,400	620	--	--	--	241	--	0.33	0.0035	**620**	**620**	**241**	**--**
Petroleum Hydrocarbons and Constituents (mg/kg) [g]													
TPH (as diesel)	3,200	1,380	700	--	--	115	15,000	10	0.001	**700**	**1,380**	**115**	**15,000**
TPH (as fuel oil)[i]	4,500	1,900	980	--	--	160	15,000	10	0.005	**980**	**1,900**	**160**	**15,000**
TPH (as gasoline)	2,400	1,030	610	--	--	100	5,000	1.0	0.001	**610**	**1,030**	**100**	**5,000**
Benzene	1.5	0.6	40	--	--	0.005	140	0.005	0.005	**0.6**	**0.6**	**0.005**	**140**
Toluene	1,200	530	270	--	--	0.005	420	0.005	0.005	**270**	**530**	**0.005**	**420**
Ethylbenzene	1,900	840	125	--	--	0.009	60	0.010	0.005	**125**	**840**	**0.009**	**60**
Total Xylenes	2,500	1,080	55	--	--	0.009	180	0.005	0.005	**55**	**1,080**	**0.009**	**180**

Notes

bgs - below ground surface
µg/kg - micrograms per kilogram
mg/kg - milligrams per kilogram
PAHs - Polycyclic aromatic hydrocarbons
TPH - Total petroleum hydrocarbons
QAPP - Quality Assurance Project Plan
--- = Cleanup level is not available.

a Cleanup level values listed are obtained from Tables 1, 2 and 4 of Regional Water Quality Control Board, San Francisco Bay Region, Order R2-2003-0080, Revised Site Cleanup Requirements (SCRs), August 2003.
b Although the Building 1349 Study Area is located within a planned recreational land use zone, more conservative residential cleanup levels have been used to evaluate risk, select COCs, and facilitate follow-on decisions for potential unrestricted land use of a remedial unit, post remediation.
c Residential and ecological cleanup levels are the applicable cleanup levels for soil from 0 to 3 feet bgs. For metals, background concentrations for serpentinite soil are selected if higher.
d Residential cleanup levels are the applicable cleanup levels for soil from 3 to 10 feet bgs. For metals, background concentrations for serpentinite soil are selected if higher.
e Protection of groundwater resources cleanup levels for soil to maintain drinking water standards in groundwater are the applicable cleanup levels for soil greater than 10 feet bgs.
f Cleanup levels and background concentrations for metals obtained from Cleanup Levels Document (EKI, 2002).
g Cleanup levels for petroleum-related compounds obtained from SCRs, Order No. R2-2003-080 (RWQCB, 2003).
h Cleanup level obtained from Table 7-2 (Non-petroleum compounds) in the Cleanup Levels Document (EKI, 2002)
i These values also apply to TPH as motor oil.

Table 3-2
Summary of Groundwater Cleanup Levels
Building 1349 Area
Presidio of San Francisco, California

Chemical	QAPP Analytical Reporting Limits (µg/L)	Laboratory Reporting Limits (µg/L)	Drinking Water Groundwater Cleanup Level[a] (µg/L)
Petroleum Hydrocarbons and Constituents			
TPHg (C_7-C_{12})	50	50	770
TPHd (C_{12}-C_{24})	50	50	880
TPHfo [b] (C_{24}-C_{36})	300	250	1,200
Benzene	0.01	0.5	1.0
Toluene	0.05	0.5	150
Ethylbenzene	0.5	0.5	700
Total Xylenes	0.5	0.5	1,750
Polycyclic Aromatic Hydrocarbons (PAHs)			
Acenaphthene	10	0.2	420[c]
Acenapthylene	10	0.2	280[c]
Anthracene	10	0.5	770
Benzo(a)anthracene	10	0.1	0.1
Benzo(a)pyrene	10	0.1	0.2
Benzo(b)fluoranthene	10	0.2	0.2
Benzo(g,h,i)perylene	10	0.2	150
Benzo(k)fluoranthene	10	0.1	2
Chrysene	10	0.1	20
Dibenzo(a,h)anthracene	10	0.2	0.0085[c,d]
Flouranthene	10	0.4	300
Fluorene	10	1	300
Naphthalene	10	1	300
Indeno(1,2,3-cd)pyrene	10	0.14	0.029[c,d]
Phenanthrene	10	0.5	230
Pyrene	10	0.2	230
Volatile Organic Compounds (VOCs)			
2-butanone	10	10	4,200[c]
Acetone	10	10	700[c]
Bromoform	0.5	1	100[c]
Carbon disulfide	5	0.5	--
Dibromochloromethane	0.5	0.5	100[c]
Methyl t-butyl ether (MTBE)	2	0.5	13

Table 3-2
Summary of Groundwater Cleanup Levels
Building 1349 Area
Presidio of San Francisco, California

Chemical	QAPP Analytical Reporting Limits (µg/L)	Laboratory Reporting Limits (µg/L)	Drinking Water Groundwater Cleanup Level[a] (µg/L)
Metals			
Aluminum	50	50	--
Antimony	2	1	6
Arsenic	2	1	10
Barium	1	1	1,000
Beryllium	1	1	4
Cadmium	1	1	5
Calcium	50	50	--
Chromium	2	1	50
Chromium VI	0.5	10	21[c]
Cobalt	1	1	140[c]
Copper	2	1	1,000
Iron	50	50	--
Lead	1	1	15
Magnesium	50	50	--
Manganese	1	1	--
Mercury	0.2	0.2	2
Nickel	2	1	100
Potassium	50	50	--
Selenium	2	1	50
Silver	1	1	50
Sodium	50	50	--
Thallium	1	1	2
Vanadium	10	1	15[c]
Zinc	2	20	5,000

Table 3-2
Summary of Groundwater Cleanup Levels
Building 1349 Area
Presidio of San Francisco, California

Chemical	QAPP Analytical Reporting Limits (µg/L)	Laboratory Reporting Limits (µg/L)	Drinking Water Groundwater Cleanup Level[a] (µg/L)
Pesticides			
Aldrin	0.05	0.05	0.002[c,d]
alpha-BHC	0.05	0.05	---
beta -BHC	0.05	0.05	0.3
delta-BHC	0.05	0.05	---
gamma-BHC	0.05	0.05	0.2
Chlordane (alpha and gamma)[e]	0.5	0.05	0.1
4,4-DDD	0.1	0.01	0.15[c]
4,4-DDE	0.1	0.01	0.10[c]
4,4-DDT	0.1	0.01	0.10[c]
Dieldrin	0.1	0.05	0.5
Endosulfan	0.1	0.01	42[c]
Endosulfan sulfate	0.1	0.1	---
Endrin	0.1	0.01	2
Endrin aldehyde	0.1	0.1	2
Heptachlor	0.05	0.025	0.01[d]
Heptachlor epoxide	0.05	0.025	0.01[d]
Methoxychlor	0.5	0.025	40

Notes

µg/L - micrograms per liter
--- = Cleanup level is not available.
QAPP - Quality Assurance Project Plan
TPHd - total petroleum hydrocarbons as diesel
TPHg - total petroleum hydrocarbons as gasoline
TPHfo - total petroleum hydrocarbons as fuel oil

a Development of Presidio-wide Cleanup Levels for Soil, Sediment, Groundwater and Surface Water, Presidio of San Francisco (EKI, 2002), Table 7-6, Cleanup Levels for Surface Water, Seeps, and Groundwater at the Presidio of San Francisco (Drinking Water Cleanup Level) or maximum contaminant levels (MCLs), if available.

b These values also apply to TPH as motor oil.
c Values are Environmental Screening Levels (ESLs) for drinking water (RWQCB, 2003b).
d Drinking water level is lower than laboratory reporting limit. Therefore, laboratory reporting limit is selected as achievable cleanup level.
e Cleanup level for chlordane is applied to both alpha and gamma isomers. Both isomers are reported in laboratory data.

Table 3-3
Summary of Remedial Units and Contaminants of Concern
Building 1349 Area
Presidio of San Francisco, California

Remedial Units	Depth (feet)	Estimated Surface Area (square feet)	Estimated Thickness (feet)	Estimated Volume In-Situ (cubic yards)	COCs
SOIL					
Shallow Soil - Area 1	0 -10 feet bgs (1)	1700	10	630	TPHd, TPHfo B(a)P, D(a,h)A, chrysene
Shallow Soil - Area 2	0 - 10 feet bgs (1)	161	10	59	B(a)P, D(a,h)A
Shallow Soil - Area 3	0 - 10 feet bgs (1)	243	10	90	TPHd
Deep Soil	10 - 22 feet bgs	67	12	30	TPHd
Telecommunications Conduit	0 - 16 feet bgs (2)	642	16	380	TPHd, PAHs
Total				**1190**	
GROUNDWATER					
Building 1349 Area Groundwater	NA	NA	NA	NA	TPHd, TPHg, benzene, B(a)A, OCPs, arsenic

Notes
NA - Not Applicable
TPHd - TPH as diesel fuel
TPHfo - TPH as fuel oil
TPH - Total petroleum hydrocarbons
B(a)P - Benzo(a)Pyrene
B(a)A - Benzo(a)Antrhacene
D(a,h)A - Dibenz(a,h)Anthracene
OCPs - Organochlorine pesticides
COCs - Contaminants of Concern

(1) for conservative estimation, excavation assumed to extend to a maximum of 10 feet bgs. Actual depth and limits of excavation will be determined by post excavation confirmation sampling.
(2) 16 feet bgs assumed as an estimate for approximate depth of contamination before bedrock. Actual depth and limits of excavation will be determined by post excavation confirmation sampling.

Table 4-1
Summary of Potential Remedial Technologies -
Shallow Soil, Deep Soil, Telecommunications Corridor Soil and Groundwater
Building 1349 Area
Presidio of San Francisco, CA

Remedial Unit	Remedial Technology	
Shallow Soil	No Action	
	Excavation and Offsite Disposal	
	Capping	
	Land Use Controls	
	In Situ	Bioremediation (Bioventing and Enhanced Bioremediation)
		SVE
Deep Soil	No Action	
	Excavation and Offsite Disposal	
	Subsurface Capping	
	In Situ	Bioremediation (Bioventing and Enhanced Bioremediation)
		SVE
Telecommunications Corridor Soil	No Action	
	Excavation and Offsite Disposal	
	Capping	
	Land Use Controls	
	In Situ	Bioremediation (Bioventing and Enhanced Bioremediation)
		SVE
Groundwater	No Action	
	Groundwater Monitoring	
	Land Use Controls	
	In Situ	Enhanced Bioremediation (ORC, hydrogen peroxide)
		Air Sparging
		Chemical Oxidation (hydrogen peroxide + iron, ozone)
	Extraction and Treatment	

Table 4-2
Screening of Soil Remediation Technologies
Shallow Soil Remedial Unit (0 to 10 feet below ground surface)
Building 1349
Presidio of San Francisco, California

Remedial Technology			**Technology Description**	**Comments**	**Screening**			
					Technical Effectiveness	**Implementability**	**Cost**	**Technology Retained**
No Action			Shallow soil remains in place and reduction of impacts limited to naturally-occurring biodegradation.	Not protective of human health or the environment.	Low	Low	Low	Yes
Excavation and Offsite Disposal			Shallow soil removed with conventional excavating equipment, characterized, and disposed of at an appropriate facility. Effectiveness verified by confirmation soil sampling.	Removes shallow soil contamination. Protective of human health and environment. Uses readily available equipment.	High	High	High	Yes
Capping			Shallow soil capped with a low permeable soil (10-6 cm/s) or synthetic material to mitigate leaching of TPH and PAHs from the affected soil to underlying groundwater. Land use controls implemented to maintain the integrity of the cap.	Readily available, low-tech equipment. Minimizes exposure for human and ecological receptors and potential leaching to underlying groundwater, but leaves contaminated soil in place. Would require land use control and long term O&M.	Moderate	Moderate	High	Yes
Land Use Controls			Shallow soil remains in place and reduction of impacts limited to naturally-occurring biodegradation. Land use controls implemented to restrict access in the vicinity of impacted soil and maintain integrity of surface soil.	Protective of human health and environment, but leaves contaminated soil in place. Impacted soil is 2 ft bgs and deeper.	Moderate	Moderate	Low	Yes

Table 4-2
Screening of Soil Remediation Technologies
Shallow Soil Remedial Unit (0 to 10 feet below ground surface)
Building 1349
Presidio of San Francisco, California

Remedial Technology			Technology Description	Comments	Screening			
					Technical Effectiveness	Implementability	Cost	Technology Retained
In Situ	Bioremediation	Bioventing	Utilizes naturally occurring microorganisms to biodegrade organic constituents absorbed to soils in the unsaturated zone. Air injection wells are installed by standard well-drilling methods (vertical, angled, or horizontal) used in unsaturated zones. The increased supply of oxygen (as air) serves to accelerate the rate of naturally occurring aerobic contaminant biodegradation.	Uses low-profile, low-tech equipment. Effective at degrading TPH and PAHs. Does not require handling of chemicals. A basic assumption of in-situ treatment is that the material is uniform and homogeneous. The shallow soil RU consists of discrete volumes of contaminated material in silty clay/clayey silt (slope debris and ravine fill and weathered bedrock with evidence of secondary mineralization of fractures) which has low permeability and is heterogeneous. This lithology would likely produce preferential flow paths and thus soil would not be remediated uniformly.	Low	Moderate	High	No
		Enhanced Bioremediation	Uses oxygen-releasing product to time-release oxygen into the subsurface via soil borings. The increased supply of oxygen serves to accelerate the rate of naturally occurring aerobic contaminant biodegradation.	Uses standard drilling equipment. Effective at degrading TPH and PAHs. A basic assumption of in-situ treatment is that the material is uniform and homogeneous. The shallow soil RU consists of discrete volumes of contaminated material in silty clay/clayey silt (slope debris and ravine fill and weathered bedrock with evidence of secondary mineralization of fractures) which has low permeability and is heterogeneous. This lithology would likely produce preferential flow paths and thus would not be remediated uniformly. Not effective in unsaturated soil.	Low	Moderate	High	No
	Extraction	Soil Vapor Extraction(SVE)	Volatile constituents absorbed to soils in unsaturated zone are volatilized by applying a vacuum. Resulting vapors are extracted for treatment.	SVE targets VOCs and some SVOCs but not heavier hydrocarbons such as TPHd. Method is not effective to remediate shallow soil contamination in Building 1349 Study Area due to soil and weathered bedrock with low permeability. Study Area lithology would likely produce preferential paths and thus would not be remediated uniformly.	Low	Moderate	High	No

Note: Definitions for Effectiveness, Implementability and Cost.

Technical Effectiveness: Technical effectiveness refers to the ability of a technology to address: 1) the estimated area or volumes of media requiring remediation to meet the RAOs; 2) the potential impacts to human health and the environment during implementation and any construction; and 3) the long-term reliability and proven history of the technology with respect to the types of chemicals and conditions at the sites.

Implementability: Implementability refers to both the technical and institutional feasibility of implementing a particular remedial technology, including: 1) the likelihood of obtaining permits and approvals from regulatory agencies; 2) availability of appropriate treatment, storage, and disposal facilities (TSDFs); and 3) availability of the equipment, materials and skilled workers necessary to implement the particular technology.

Cost-Effectiveness: Cost-effectiveness includes assessing the relative capital and operation and maintenance (O&M) costs associated with a particular technology. Costs are estimated using best engineering judgment at the time of the estimate. Cost-effectiveness weighs required expenditures against potential benefits, and is used to eliminate options that are substantially more expensive than other process options providing the same level of protection.

Table 4-3
Screening of Soil Remediation Technologies
Deep Soil Remedial Unit (greater than 10 feet below ground surface)
Building 1349
Presidio of San Francisco, California

Remedial Technology			Technology Description	Comments	Screening: Technical Effectiveness	Screening: Implementability	Screening: Cost	Screening: Technology Retained
No Action			Deep soil remains in place and reduction of impacts limited to naturally-occurring biodegradation.	Provides no additional control to prevent potential impacts to groundwater.	Low	Low	Low	Yes
Excavation and Offsite Disposal			Deeper soil would be removed with conventional excavating equipment, characterized, and disposed of at an appropriate facility. Effectiveness would be verified by confirmation sampling.	Presence of competent bedrock may impede technical effectiveness.	High	Moderate	High	Yes
Subsurface Capping			Assumes shallow soil excavated for offsite disposal. Deeper soil would be capped with a low permeable soil or synthetic material to mitigate leaching of TPH and PAHs from the affected soil to the underlying groundwater. Land-use controls would be implemented to maintain the cap integrity.	Method is effective to isolate soil from surface water infiltration, therefore chemicals left in place are not readily leachable to groundwater. Would require land use control and long-term O&M.	Moderate	Moderate	High	Yes
In Situ	Bioremediation	Bioventing	Utilizes naturally occurring microorganisms to biodegrade organic constituents absorbed to soils in the unsaturated zone. Air injection wells are installed by standard well-drilling methods (vertical, angled, or horizontal) used in unsaturated zones. The increased supply of oxygen (as air) serves to accelerate the rate of naturally occurring aerobic contaminant biodegradation.	Uses low-profile, low-tech equipment. Effective at degrading TPH and PAHs. Does not require handling of chemicals. A basic assumption of in-situ treatment is that the material is uniform and homogeneous. The deep soil RU consists of contaminated material in silty clay/clayey silt (slope debris and ravine fill and weathered bedrock with evidence of secondary mineralization of fractures) and weathered bedrock which has low permeability and is heterogeneous. This lithology would likely produce preferential flow paths and thus soil would not be remediated uniformly.	Low	Moderate	High	No
		Enhanced Bioremediation	Uses oxygen-releasing product to time-release oxygen into the subsurface via soil borings. The increased supply of oxygen serves to accelerate the rate of naturally occurring aerobic contaminant biodegradation.	Method is not effective due to the low permeable soils and bedrock which would decrease the effectiveness of this technology. (See comments for bioventing). Not effective in unsaturated soil. Uses standard drilling equipment. Effective at degrading TPH and PAHs.	Low	Moderate	High	No
	Soil Vapor Extraction	Soil Vapor Extraction (SVE)	Volatile constituents absorbed to soils in unsaturated zone are volatilized by applying a vacuum. Resulting vapors are extracted for treatment.	Method is not effective due to absence of lighter (more volatile) petroleum hydrocarbons; method is not effective for heavier TPH fractions. In addition, low permeabilty of soil and bedrock will impede volatilization.	Low	Moderate	High	No

Table 4-3
Screening of Soil Remediation Technologies
Deep Soil Remedial Unit (greater than 10 feet below ground surface)
Building 1349
Presidio of San Francisco, California

Note: Definitions for Effectiveness, Implementability and Cost.

Technical Effectiveness: Technical effectiveness refers to the ability of a technology to address: 1) the estimated area or volumes of media requiring remediation to meet the RAOs; 2) the potential impacts to human health and the environment during implementation and any construction; and 3) the long-term reliability and proven history of the technology with respect to the types of chemicals and conditions at the sites.

Implementability: Implementability refers to both the technical and institutional feasibility of implementing a particular remedial technology, including: 1) the likelihood of obtaining permits and approvals from regulatory agencies; 2) availability of appropriate treatment, storage, and disposal facilities (TSDFs); and 3) availability of the equipment, materials and skilled workers necessary to implement the particular technology.

Cost-Effectiveness: Cost-effectiveness includes assessing the relative capital and operation and maintenance (O&M) costs associated with a particular technology. Costs are estimated using best engineering judgment at the time of the estimate. Cost-effectiveness weighs required expenditures against potential benefits, and is used to eliminate options that are substantially more expensive than other process options providing the same level of protection.

Table 4-4
Screening of Soil Remediation Technologies
Telecommunications Corridor Soil Remedial Unit
Building 1349
Presidio of San Francisco, California

DRAFT

Remedial Technology			Technology Description	Effectiveness in Telecommunications Conduit	Screening: Technical Effectiveness	Screening: Implementability	Screening: Cost	Screening: Technology Retained
No Action			Soil beneath the telecommunications conduit would remain in place and reduction of impacts limited to naturally-occurring biodegradation.	Not protective of human health or the environment	Low	Low	Low	Yes
Excavation and Offsite Disposal			Soils would be removed with conventional excavating equipment, characterized, and disposed of at an appropriate facility. Effectiveness would be verified by confirmation sampling.	Telecommunication conduit would need to be rerouted. Well 1349MW100 would need to be abandoned and replaced. Presence of competent bedrock may impede technical effectiveness.	High	Moderate to High	High	Yes
Capping			Soil would be capped with a low permeable soil or synthetic material to mitigate leaching of TPH and PAHs from the affected soil to the underlying groundwater. Land use controls would be implemented to maintain the integrity of the cap.	Telecommunication conduit may provide pathway for water to move below cap and infiltrate through impacted area to groundwater, but expected to be minor. Readily available, low-tech equipment. Would require land use control and long term O&M. Minimizes exposure to human and ecological receptors.	Moderate	Moderate	High	Yes
Land Use Controls			Soil would remain in place and reduction of impacts limited to naturally-occurring biodegradation. Land use controls implemented to restrict access in the vicinity of impacted soil and maintain integrity of surface soil.	Readily available, protective of telecommunications conduit. Leaves contamination in place. Would not be effective for deep soil below 10 feet which contains COCs above cleanup levels protective of groundwater.	Moderate	Moderate	Low	Yes
In Situ	**Bioremediation**	Bioventing	Utilizes naturally occurring microorganisms to biodegrade organic constituents absorbed to soils in the unsaturated zone. Air injection wells are installed by standard well-drilling methods (vertical, angled, or horizontal) used in unsaturated zones. The increased supply of oxygen (as air) serves to accelerate the rate of naturally occurring aerobic contaminant biodegradation.	Uses low-profile, low-tech equipment. Effective at degrading TPH and PAHs. Does not require handling of chemicals. A basic assumption of in-situ treatment is that the material is uniform and homogeneous. The deep soil RU consists of contaminated material in silty clay/clayey silt (slope debris and ravine fill and weathered bedrock with evidence of secondary mineralization of fractures) and weathered bedrock which has low permeability and is heterogeneous. This lithology would likely produce preferential flow paths and thus soil would not be remediated uniformly.	Low	Moderate	High	No
		Enhanced Bioremediation	Uses oxygen-releasing product to time-release oxygen into the subsurface via soil borings. The increased supply of oxygen serves to accelerate the rate of naturally occurring aerobic contaminant biodegradation.	Method is not effective due to low permeable bedrock and soil (see comments for bioventing). Not effective in unsaturated soil.	Low	Moderate	High	No
	Soil Vapor Extraction	Soil Vapor Extraction (SVE)	Volatile constituents absorbed to soils in unsaturated zone are volatilized by applying a vacuum. Resulting vapors are extracted for treatment.	Method is not effective due to absence of lighter (more volatile) petroleum hydrocarbons; method is not effective for heavier TPH fractions. In addition, low permeabilty of soil and bedrock will impede volatilization.	Low	Moderate	High	No

Table 4-4
Screening of Soil Remediation Technologies
Telecommunications Corridor Soil Remedial Unit
Building 1349
Presidio of San Francisco, California

Note: Definitions for Effectiveness, Implementability and Cost.

Technical Effectiveness: Technical effectiveness refers to the ability of a technology to address: 1) the estimated area or volumes of media requiring remediation to meet the RAOs; 2) the potential impacts to human health and the environment during implementation and any construction; and 3) the long-term reliability and proven history of the technology with respect to the types of chemicals and conditions at the sites.

Implementability: Implementability refers to both the technical and institutional feasibility of implementing a particular remedial technology, including: 1) the likelihood of obtaining permits and approvals from regulatory agencies; 2) availability of appropriate treatment, storage, and disposal facilities (TSDFs); and 3) availability of the equipment, materials and skilled workers necessary to implement the particular technology.

Cost-Effectiveness: Cost-effectiveness includes assessing the relative capital and operation and maintenance (O&M) costs associated with a particular technology. Costs are estimated using best engineering judgment at the time of the estimate. Cost-effectiveness weighs required expenditures against potential benefits, and is used to eliminate options that are substantially more expensive than other process options providing the same level of protection.

Table 4-5
Screening of Groundwater Remediation Technologies
Groundwater Remedial Unit
Builing 1349
Presidio of San Francisco, California

Remedial Technology		Technology Description	Comments	Screening: Technical Effectiveness	Implementability	Cost	Technology Retained
No Action		Impacted groundwater remains in place and reduction of impacts limited to naturally-occurring biodegradation.	Method is not effective in monitoring chemical distribution over time or evaluating the downgradient extent of impacts. Not in compliance with RWQCB Basin Plan, RWQCB Order No. R2-2003-0080, or SWRCB Resolution 92-49.	Low	Low	Low	Yes
		Existing groundwater wells would be abandoned.					
Groundwater Monitoring		Impacted groundwater would remain in place.	Method is effective in monitoring chemical distribution as well as monitoring natural degradation processes over time and assessing attainment of cleanup levels.	High	High	High	Yes
		Existing groundwater wells would monitored for a period of up to 5 years.	By installing new groundwater monitoring wells near 1349MW100, the extent of impacts may be further evaluated.				
		Two additional groundwater monitoring wells would be installed in vicinity of 1349MW100.					
Land Use Controls		Impacted groundwater would remain in place and use would be restricted.	Would require RWQCB changes in beneficial use restrictions. Not in compliance with RWQCB Basin Plan, RWQCB Order No. R2-2003-0080, or SWRCB Resolution 92-49.	Moderate	Moderate	Low	Yes

Table 4-5
Screening of Groundwater Remediation Technologies
Groundwater Remedial Unit
Builing 1349
Presidio of San Francisco, California

Remedial Technology		Technology Description	Comments	Screening: Technical Effectiveness	Screening: Implementability	Screening: Cost	Screening: Technology Retained
In-Situ	Enhanced Bioremediation	Enhanced bioremediation of groundwater involves enhancing growth of naturally occurring microorganisms in order to promote aerobic degradation of contaminants. This can be done by using products such as ORC® or hydrogen peroxide to release oxygen into the groundwater.	ORC® can be applied actively (injecting a slurry, straight powder application in excavation, or mixture of water and powder in excavation) or passively (filter sock placed in wells). However, technology has constraints due to site lithology. Anisotropic fracture flow network with secondary mineralization limits the effective delivery of ORC® through injection or passive methods. Contact time with COCs	Low	Moderate	High	No
In-Situ	Air Sparging	Air is injected through contaminated aquifer by compressed air pumped through injection wells. Air bubbles volatilize contaminants in saturated zone and are extracted from the unsaturated zone.	Saturated zone is not uniform which can result in uncontrolled movement of potentially hazardous vapors. Soil heterogeneity may cause some zones to be unaffected by treatment. Impacted zones likely would not be uniformly treated.	Low	Moderate	High	No
In-Situ	Chemical Oxidation	This alternative would involve the introduction of an oxidant into the subsurface through the existing impacted monitoring well (1349MW100) and additional locations. Upon contact, organic material including petroleum hydrocarbons would be rapidly oxidized.	Oxidant contact with contaminant is limited by diffusion in soils and weathered bedrock with low permeability like clays and silts. Other limitations include handling large quantities of chemicals and the potential for naturally occuring metals solubility.	Low	Moderate	High	No
Extraction and Treatment	Pump and Treat	Install groundwater extraction wells in the vicinity of the groundwater impacts that exceed the cleanup levels. Pump groundwater from the underlying aquifer to an aboveground treatment system.	Method is not effective due to low and intermittent permeability of aquifer and low and variable specific yields of aquifer rates.	Low	Moderate	High	No

Note: Definitions for Effectiveness, Implementability and Cost.

Technical Effectiveness: Technical effectiveness refers to the ability of a technology to address: 1) the estimated area or volumes of media requiring remediation to meet the RAOs; 2) the potential impacts to human health and the environment during implementation and any construction; and 3) the long-term reliability and proven history of the technology with respect to the types of chemicals ar conditions at the sites.

Implementability: Implementability refers to both the technical and institutional feasibility of implementing a particular remedial technology, including: 1) the likelihood of obtaining permits and approvals from regulatory agencies; 2) availability of appropriate treatment, storage, and disposal facilities (TSDFs); and 3) availability of the equipment, materials and skilled workers necessary to implement the particular technology.

Cost-Effectiveness: Cost-effectiveness includes assessing the relative capital and operation and maintenance (O&M) costs associated with a particular technology. Costs are estimated using best engineering judgment at the time of the estimate. Cost-effectiveness weighs required expenditures against potential benefits, and is used to eliminate options that are substantially more expensive than other process options providing the same level of protection.

Table 4-6
Evaluation of Alternative Summary
Building 1349
Presidio of San Francisco, California

Remedial Units	CAP Evaluation Criteria	Shallow Soil Remedial Unit Alternatives			
		No Action	**Excavation and Off-site Disposal**	**Capping**	**Land-Use Controls**
		Objective. The objective of this alternative is to provide no additional control or protection to human health or the environment for contamination that exists in the soil at the Building 1349 Area beyond naturally-occurring degradation.	**Objective.** The objective of this alternative is to remove soil contamination and dispose of waste materials off-site at a permitted recycling and/or disposal facility, as appropriate.	**Objective.** The objective of this alternative is to install a cap at the surface. Land Use Controls will be put in place to restrict access to the impacted areas.	**Objective.** The objective of this alternative is to maintain existing ground cover and prevent exposure to contamination.
Shallow Soil	**1) Technical Effectiveness**	This alternative will not address the area or volumes of impacted soil requiring remediation and contaminant mass reduction would be limited to natural degradation. This alternative does not protect human health and the environment.	This alternative addresses the entire area and volume of impacted soil requiring remediation. Potential adverse impacts to human health and the environment during implementation can be readily mitigated using standard construction practices (e.g., dust control during excavation). Excavation and off-site disposal has a proven history with respect to the constituents of concern at the site and is applicable to all soil types.	Soil is impacted 2 feet bgs and deeper. This alternative would be effective in minimizing future infiltration of surface water through the impacted soil to groundwater and limiting exposure of humans and ecological receptors to contamination. Contamination would remain in-place in soil.	Soil is impacted 2 feet bgs and deeper. This alternative would be effective in minimizing exposure of humans and ecological receptors to contamination but would not be effective in minimizing future infiltration of surface water through the impacted soil to groundwater. Contamination would remain in-place in soil.
	2) Implementability	This alternative is unlikely to obtain approvals from regulatory agencies. This technology does not require any treatment, storage, and disposal of material.	This alternative would likely obtain approvals from regulatory agencies. Appropriate TSDFs for off-site recycling or disposal of excavated soil are available. The equipment, materials, and skilled workers for excavation and off-site disposal of impacted soil are readily available. Relatively short time is required for implementation.	This alternative is technically feasible. Soil will be excavated 2-3 feet and properly disposed before construction of the cap. Contaminant mass reduction would be limited to the biodegradation rate, which may be affected by the lack of recharge of nutrients and moisture. This alternative would require long-term maintenance of the cap and land use controls.	This alternative is readily implementable. Contaminant mass reduction would be limited to the biodegradation rate. This alternative would require long-term maintenance of the land use controls.
	3) Cost-Effectiveness	Although relatively low to no cost, this remedy provides no protection to human health and the environment.	This alternative has a higher cost to implement but provides a greater level of protection of human health and the environment than the no action alternative.	This alternative has moderate capital costs associated with the capping of the surface soil but would require long-term O&M costs making it a higher cost alternative.	This alternative is relatively low in capital costs and provides a moderate level of protection for human health and the environment. This alternative would require O&M annual costs.
Summary of Evaluation Criteria for Shallow Soil		**Alternative is Not Recommended.** Concentrations in soil are greater than applicable cleanup levels and may pose an unacceptable risk to human health and the environment.	**Alternative is Recommended as the Preferred Remedy for the Shallow Soil RU.** This alternative would provide a permanent solution and removes the impacted soil to levels below applicable cleanup standards.	**Alternative is Not Recommended.** Concentrations in soil are greater than applicable cleanup levels and protection of human health and ecological receptors relies on long-term O&M of cap and land use controls. Contamination remains in-place in soil.	**Alternative is Not Recommended.** Concentrations in soil are greater than applicable cleanup levels and protection of human health and ecological receptors relies on long-term maintenance of land use controls. Contamination remains in-place in soil.

Table 4-6
Evaluation of Alternative Summary
Building 1349
Presidio of San Francisco, California

Remedial Units	CAP Evaluation Criteria	Deep Soil Remedial Unit Alternatives		
		No Action	Excavation and Offsite Disposal	Subsurface Capping
		Objective. The objective of this alternative is to provide no additional control for contamination that exists in the soil at the Building 1349 Area beyond naturally-occurring degradation.	**Objective.** The objective of this alternative is to remove soil contamination and dispose of waste materials off-site at a permitted recycling and/or disposal facility, as appropriate.	**Objective.** The objective of this alternative is to install a cap at approximately 10 feet bgs (assuming that the Shallow Soil RU is excavated to 10 feet bgs). Land Use Controls will be put in place to restrict access to the impacted deep soil.
Deep Soil	1) Technical Effectiveness	This alternative will not be able to address the area or volumes of impacted soil requiring remediation and contaminant mass reduction would be limited to natural degradation. This alternative would not be effective in reducing chemical concentrations to levels protective of groundwater.	This alternative is able to address the entire area and volume of impacted soil requiring remediation. Potential adverse impacts to human health and the environment during implementation can be readily mitigated using standard construction practices (e.g., dust control during excavation). Excavation and off-site disposal has a proven history with respect to the constituents of concern at the site.	This alternative would be effective in minimizing future infiltration of surface water through the impacted soil to groundwater. Contamination would remain in-place in soil.
	2) Implementability	This alternative is unlikely to obtain approvals from regulatory agencies. This technology does not require any treatment, storage, and disposal facilities of material	This alternative would likely obtain approvals from regulatory agencies. Appropriate TSDFs for off-site disposal of excavated soil are available. The equipment, materials, and skilled workers for excavation and off-site disposal of impacted soil are readily available. There is a possibility that excavation will not be feasible due to presence of bedrock or slope stability.	This alternative is technically feasible if the shallow soils are excavated as part of the remediation of the Shallow Soil RU (preferred alternative is excavation). Before the excavation is backfilled an impermeable cap will be constructed at approximately 10 feet bgs. Contaminant mass reduction would be limited to the biodegradation rate, which may be affected by the lack of recharge of nutrients and moisture. This alternative would require long-term maintenance of the cap and land use controls. This alternative would require long-term maintenance of the cap and land use controls to safeguard the integrity of the cap.
	3) Cost-Effectiveness	Although relatively low to no cost, this remedy provides very little protection to groundwater resources.	This alternative has a moderate capital cost to implement but provides a greater level of protection for groundwater resources than the no action alternative.	This alternative has a high cost associated with the capping of the deep soil at a depth below ground surface and would require long-term O&M costs.
Summary of Evaluation Criteria for Deep Soil		**Alternative is Not Recommended.** Concentrations in soil are greater than applicable cleanup levels and may pose an unacceptable risk to groundwater resources.	**Alternative is Recommended as the Preferred Remedy for the Deep Soil RU.** This alternative would provide a permanent solution and removes the impacted soil to levels below applicable cleanup standards. If bedrock conditions preclude excavation of all impacted soil, the contamination will be left in-place and groundwater monitoring will be conducted to confirm that groundwater is not impacted by soil COCs. Current and historical groundwater data from well 1349MW103 demonstrate that soil has not impacted groundwater in the area.	**Alternative is Not Recommended.** Concentrations in soil are greater than applicable cleanup levels and protection of groundwater relies on long-term O&M of cap and land use controls. Contamination remains in-place in soil.

Table 4-6
Evaluation of Alternative Summary
Building 1349
Presidio of San Francisco, California

Remedial Units	CAP Evaluation Criteria	Telecommunications Corridor Remedial Unit Alternatives: No Action	Excavation and Offsite Disposal	Capping	Land Use Controls
		Objective. The objective of this alternative is to provide no additional control or protection to human health or the environment for contamination that exists in the soil at the Building 1349 Area beyond naturally-occurring degradation.	**Objective.** The objective of this alternative is to remove soil contamination and dispose of waste materials off-site at a permitted recycling and/or disposal facility, as appropriate.	**Objective.** The objective of this alternative is to install a cap at the surface. Land Use Controls will be put in place to restrict access to the impacted areas.	**Objective.** The objective of this alternative is to maintain existing ground cover and prevent exposure to contamination.
Telecommunications Conduit Soil	**1) Technical Effectiveness**	This alternative will not address the area or volumes of impacted soil requiring remediation and contaminant mass reduction would be limited to natural degradation. This alternative does not protect human health and the environment.	This alternative is able to address the entire area and volume of impacted soil requiring remediation. Potential adverse impacts to human health and the environment during implementation can be readily mitigated using standard construction practices (e.g., dust control during excavation). Excavation and off-site disposal has a proven history with respect to the constituents of concern at the site.	Soil is impacted 3 feet bgs and deeper. This alternative would be effective minimizing infiltration of surface water through the impacted soil to groundwater, except for minor infiltration from water within the conduit, and limiting exposure of humans and ecological receptors to contamination. Contamination would remain in-place in soil.	Soil is impacted 3 feet bgs and deeper. This alternative would be effective in minimizing exposure of humans and ecological receptors to contamination but would not be effective in minimizing future infiltration of surface water through the impacted soil to groundwater. Contamination would remain in-place in soil.
	2) Implementability	This alternative is unlikely to obtain approvals from regulatory agencies. This technology does not require any treatment, storage, and disposal of materials.	This alternative would likely obtain approvals from regulatory agencies. Appropriate TSDFs for off-site disposal of excavated soil are available. The equipment, materials, and skilled workers for excavation and off-site disposal of impacted soil are readily available. The telecommunications conduit will be rerouted and well 1349MW100 will be abandoned and reinstalled. There is a possibility that excavation with conventional equipment will not be feasible due to the presence of bedrock.	This alternative is technically feasible. Soil will be excavated 2-3 feet and properly disposed before construction of the cap. Contaminant mass reduction would be limited to the biodegradation rate, which may be affected by the lack of recharge of nutrients and moisture. This alternative would require long-term maintenance of the cap and land use controls.	This alternative is readily implementable. Contaminant mass reduction would be limited to the biodegradation rate. This alternative would require long-term maintenance of the land use controls.
	3) Cost-Effectiveness	Although relatively low to no cost, this remedy provides no protection to human health and the environment.	This alternative has a higher cost to implement but provides a greater level of protection of human health and the environment than the no action alternative.	This alternative has high capital cost associated with the capping of the surface soil and would require long-term O&M costs.	This alternative is relatively low in cost and provides a moderate level of protection for human health and the environment. This alternative would require O&M costs.
Summary of Evaluation Criteria for Telecommunications Conduit Soil		**Alternative is Not Recommended.** Concentrations in soil are greater than applicable cleanup levels and may pose an unacceptable risk to human health and the environment.	**Alternative is Recommended as the Preferred Remedy for the Telecommunications Soil RU.** This alternative would provide a permanent solution and removes the impacted soil to levels below applicable cleanup standards. If bedrock conditions preclude excavation of all impacted soil, the contamination will be left in-place and groundwater monitoring will be conducted to address groundwater impacts in the vicinity of well 1349MW100.	**Alternative is Not Recommended.** Concentrations in soil are greater than applicable cleanup levels and protection of human health and ecological receptors relies on long-term maintenance of cap and land use controls. Contamination remains in-place in soil.	**Alternative is Not Recommended.** Concentrations in soil are greater than applicable cleanup levels and protection of human health and ecological receptors relies on long-term maintenance of land use controls Contamination remains in-place in soil.

Table 4-6
Evaluation of Alternative Summary
Building 1349
Presidio of San Francisco, California

Remedial Units	CAP Evaluation Criteria	Groundwater Remedial Unit Alternatives: No Action	Groundwater Remedial Unit Alternatives: Groundwater Monitoring	Groundwater Remedial Unit Alternatives: Land Use Controls
		Objective. The objective of this alternative is to provide no additional control or protection to human health or the environment for contamination that exists in groundwater at the Building 1349 Area. It includes abandoning the current groundwater monitoring network and terminating groundwater monitoring.	**Objective.** The objective of this alternative is to monitor groundwater to assess attainment of cleanup levels, confirm the extent of the plume, and assess if selected soil remedies have a positive effect on the dissolved-phase concentrations.	**Objective.** The objective of this alternative is to restrict usage of groundwater.
Groundwater	**1) Technical Effectiveness**	This alternative will not address the dissolved-phase concentrations exceeding the cleanup levels. Although use of groundwater is unlikely, this alternative is not effective in maintaining beneficial use of groundwater as a drinking water supply. This alternative will not confirm if natural degradation of COCs is occurring.	This alternative is effective in adequately monitoring the spatial distribution and COC concentrations over time of the dissolved-phase plume and confirm if natural degradation is occurring. By installing two new groundwater wells to the north and west of well 1349MW100, the extent of impacts can be evaluated. The Five-Year Status Report will demonstrate effectiveness of remedy to achieve cleanup levels.	This alternative will not address the dissolved-phase concentrations exceeding the cleanup levels. Although use of groundwater is unlikely, this alternative is not effective in maintaining beneficial use of groundwater as a drinking water supply.
	2) Implementability	This alternative is unlikely to obtain approvals from regulatory agencies and is not in accordance with the RWQCB plans and policies. This technology does not require any treatment, storage, and disposal of material.	This alternative is easily implementable and would require on-going groundwater monitoring. Two wells would be installed to the north and west of well 1349MW100.	This alternative is unlikely to obtain approvals from regulatory agencies and is not in accordance with the RWQCB plans and policies. This technology does not require any treatment, storage, and disposal of material. This alternative requires long-term maintenance of the land use controls.
	3) Cost-Effectiveness	Although relatively low to no cost, this remedy provides very little protection of groundwater as a domestic supply.	This alternative has a high cost.	Although relatively low cost, this remedy provides very little protection of groundwater as a domestic supply.
Summary of Evaluation Criteria for Groundwater		**Alternative is Not Recommended.** Concentrations in groundwater are greater than applicable cleanup levels. This alternative is not in accordance with RWQCB plans and policies.	**Alternative is Recommended as the Preferred Remedy for the Groundwater RU.** Based on the localized nature of the groundwater impacts and the concentrations of TPH and OCPs, this alternative is reasonable and the additional groundwater monitoring would be conducted to confirm attainment of cleanup levels or demonstration of decreasing COC trends. Monitoring will also determine if natural degradation processes are occurring. The Five-Year Status Report will demonstrate the effectiveness of the remedy.	**Alternative is Not Recommended.** Concentrations in groundwater are greater than applicable cleanup levels. This alternative is not in accordance with RWQCB plans and policies.

Table 5-1
Proposed Soil Confirmation Sampling and Analysis Summary
Building 1349
Presidio of San Francisco, California

Remedial Units	Depth (feet)	Estimated Surface Area (square feet)	Estimated Thickness (feet)	Estimated Volume In-Situ (cubic yards)	COCs	Confirmation Soil Samples[1,2]		Total Number of Confirmation Soil Samples	Chemical Analyses		
Shallow Soil						**Bottom**	**Sidewall**		TPH	PAHs	OCPs
Shallow Soil (Area 1)	0 - 10 feet bgs	1700	10	630	TPHd, TPHfo B(A)P D(a,h)A, Chrysene	3	10	13	13	13	0
Shallow Soil (Area 2)	0 - 10 feet bgs	161	10	60	B(a)P, D(a,h)A	1	8	9	9	9	0
Shallow Soil (Area 3)	0 - 10 feet bgs	243	10	90	TPHd	1	8	9	9	9	9
Deep Soil	10-22 feet bgs	68	12	30	TPHd	1	4	5	5	5	0
Telecommunications Corridor Soil	0-16 feet bgs	642	16	380	TPHd, PAHs	2	24	26	26	26	26

1 - Confirmation soil samples may change based on observations and actual size of excavation during field activities. Minimum frequency as follows:
Sidewall confirmation samples will be collected at a frequency of 1 sample per every 50 linear feet or one sample per sidewall assuming four sidewalls).
Bottom confirmation samples will be collected at a frequency of 1 sample per 625 square feet.
2 - proposed excavation depths may span more than one cleanup level zone. Sidewall confirmation samples will be collected from the mid-point of each potential cleanup level zone at each excavation area. Potential zones are as follows:
Shallow Soil (Areas 1-3): 0-3 feet bgs and 3-10 feet bgs
Deep Soil: >10 feet bgs and >5 feet above groundwater
Telecommunications Corridor: 0-3 feet bgs, 3-10 feet bgs, >10 feet bgs and >5 feet above groundwater and >10 feet bgs and <5 feet above groundwater
TPH - Total Petroleum Hydrocarbons
TPHd - Total Petroleum Hydrocarbons as diesel
TPHfo - Total Petroleum Hydrocarbons as fuel oil
PAHS will be analyzed by EPA Method 8720C
B(a)P - Benzo(a)Pyrene
D(a,h)A - Dibenzo(a,h)Anthracene
B(a)A - Benzo(a)anthracene
B(b)F - Benzo(b)Flouranthene
B(k)F - Benzo(k)flouranthene
OCPs - Organochlorine Pesticides

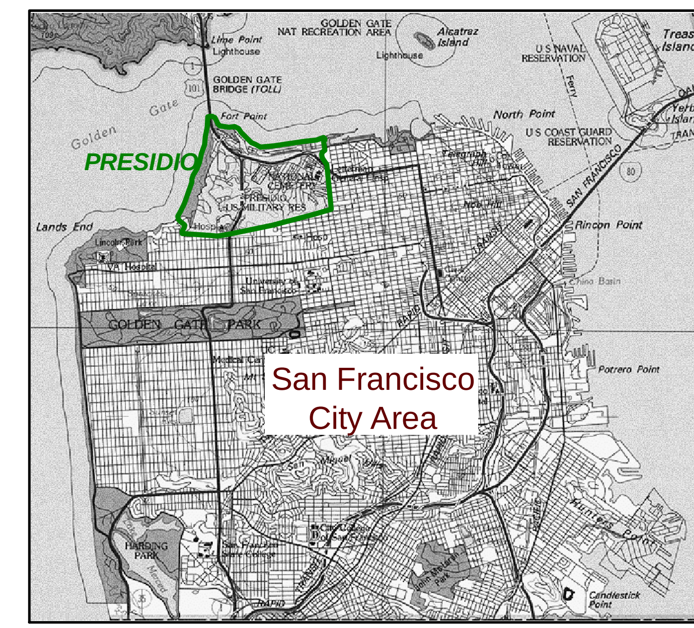
Table 5-2
Proposed Groundwater Sampling Program
Building 1349
Presidio of San Francisco, California

Monitoring Well	Remedial Unit	Sampling Frequency	General Chemistry (1) (various methods)	Total Petroleum Hydrocarbons by EPA Method 8015 Modified	Polycyclic Aromatic Hydrocarbons by EPA Method 8270C	Volatile Organic Compounds by EPA Method 8260B	Dissolved Metals by EPA Method Series 6000/7000	Organochlorine Pesticides by EPA Method 8081
1349MW01	Telecommunications Corridor RU and Groundwater RU	Q	x	x	x	x	x	x
1349MW02	Telecommunications Corridor RU and Groundwater RU	Q	x	x	x	x	x	x
1349MW03R	Groundwater RU	Q	x	x	x	x	x	x
1349MW100 (Replacement)	Deep Soil RU, Telecommunications Corridor RU, and Groundwater RU	Q	x	x	x	x	x	x
1349MW101	Groundwater RU	Q	x	x	x	x	x	x
1349MW102	Telecommunications Corridor RU and Groundwater RU	Q	x	x	x	x	x	x
1349MW103	Deep Soil RU and Groundwater RU	Q	x	x	x	x	x	x
1349MW104	Deep Soil RU and Groundwater RU	Q	x	x	x	x	x	x
1349MW105	Deep Soil RU and Groundwater RU	Q	x	x	x	x	x	x
Newly-Installed Monitoring Well #1	Telecommunications Corridor RU and Groundwater RU	Q	x	x	x	x	x	x
Newly-Installed Monitoring Well #2	Telecommunications Corridor RU and Groundwater RU	Q	x	x	x	x	x	x

Notes:
Q = Sampling will occur on a quarterly basis for a minimum of 2 years. Sampling frequency for all wells will be evaluated and adjusted accordingly for the remainder of the five-year monitoring period based on recommendations listed in Section 5.3.
(1): Samples will be analyzed for general chemistry including alkalinity, chloride, nitrate, nitrite, sulfate, sulfite and dissolved gases (both permanent gases and light hydrocarbons) as well as field parameters pH, DO, conductivity, temperature and turbidity.

Figures

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists



NOTES:

1. DRAWING NOT TO SCALE.
2. DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL AND ROLLO, OCTOBER 2003.

THE PRESIDIO TRUST
SAN FRANCISCO, CALIFORNIA

DRAFT CORRECTIVE ACTION PLAN BUILDING 1349 STUDY AREA

SITE LOCATION AND SITE STUDY AREA

THE PRESIDIO TRUST

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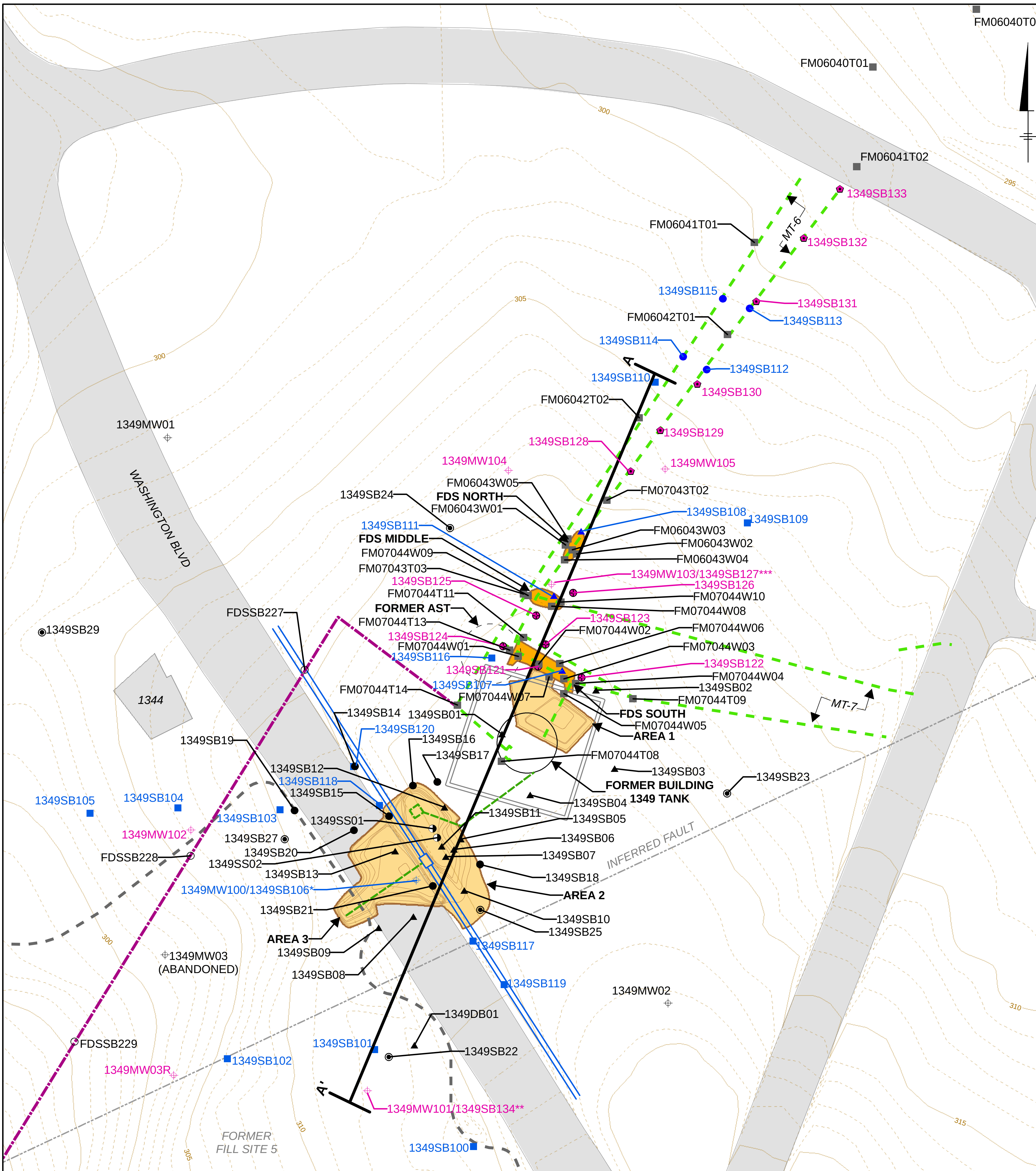
FIGURE
1-1

DRAFT

12/20/04 SYR-85 EAB
Presidio Trust-Building 1349
Q:\Presidio-Trust\C-A-P\mxd\site_locations.mxd



NOTES:

1. BASE MAP DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL & ROLLO, OCTOBER 2003.

2. LOCATION OF INFERRED FAULT FROM REVISED FEASIBILITY STUDY MAIN INSTALLATION SITES (EKI, 2003).

3. HORIZONTAL DATUM: NAD27, CA STATE PLANE COORDINATES, ZONE 3, FEET; VERTICAL DATUM: (TOPOGRAPHY) NORTH AMERICAN VERTICAL DATUM, NAVD88.

* 1349SB106 WAS CONVERTED INTO MONITORING WELL 1349MW100 ON 24 SEPTEMBER 2002.

** 1349SB134 WAS CONVERTED INTO MONITORING WELL 1349MW101 ON 2 MAY 2003.

*** 1349SB127 WAS CONVERTED INTO MONITORING WELL 1349MW103 ON 20 APRIL 2003.

LEGEND:

- PREVIOUS INSTALLED GROUNDWATER MONITORING WELL

PHASE 1 LOCATIONS

- SOURCE-SPECIFIC SOIL BORING
- DOWNGRADIENT SOIL BORING
- CONFIRMATION HAND-AUGER SOIL BORING
- GROUNDWATER MONITORING WELL

PHASE 2 LOCATIONS

- SOIL BORING
- HAND AUGER SAMPLE
- GROUNDWATER MONITORING WELL

HISTORIC SAMPLE LOCATIONS

- SOIL BORING LOCATION - PHASE 1 BY M-W
- SOIL BORING LOCATION - PHASE 2 BY M-W
- SOIL BORING LOCATION - PHASE 3 BY M-W
- SURFACE SOIL LOCATION - PHASE 3 BY M-W
- FDS PIPELINE SAMPLE LOCATION
- SOIL BORING LOCATION - FDS PIPELINE RELEASE ASSESSMENT

TOPOGRAPHIC CONTOURS

- (CONTOUR INTERVAL : 5 FT)
- (CONTOUR INTERVAL : 1 FT)
- APPROXIMATE LINE OF CROSS SECTION FOR FIGURE 2-2
- FORMER FILL SITE 5 EXCAVATION BOUNDARY
- INFERRED FAULT

- FORMER BUILDING 1349 REMEDIAL EXCAVATION AREA (1995)
- FORMER FDS REMEDIAL EXCAVATIONS
- 1344 BUILDING AND NUMBER
- COMMUNICATIONS CONDUIT
- FORMER PIPE
- FORMER FDS PIPELINE TO BUILDING 1773
- FDS TRENCH EXCAVATION
- FORMER ABOVEGROUND STORAGE TANK (AST)

- FORMER BUILDING 1349 TANK
- FORMER SECONDARY CONTAINMENT

DRAFT

THE PRESIDIO TRUST
SAN FRANCISCO, CALIFORNIA
DRAFT CORRECTIVE ACTION PLAN BUILDING 1349 STUDY AREA

BUILDING 1349 SOIL AND GROUNDWATER SAMPLE LOCATIONS

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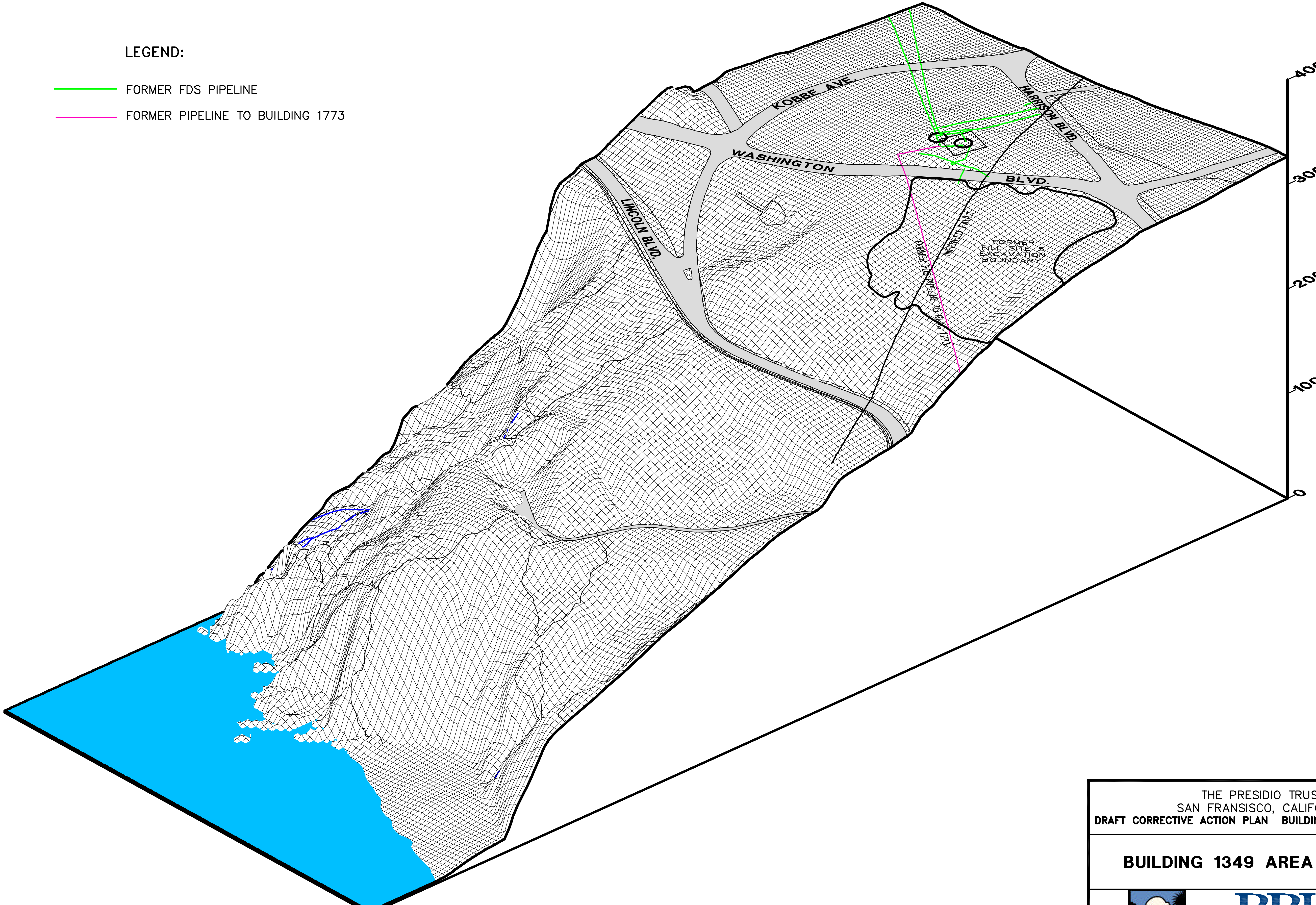
BBL BLASLAND, BOUCK & LEE, INC. engineers, scientists, economists

FIGURE
1-2

2/21/05 SYR-85 EAB
Presidio Trust- Building 1349
Q:/Presidio-trust/C-A-P/mxd/GW-SS_SampleLocations.mxd



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DRAFT CORRECTIVE ACTION PLAN BUILDING 1349 STUDY AREA

BUILDING 1349 AREA 3-D MAP

BBL
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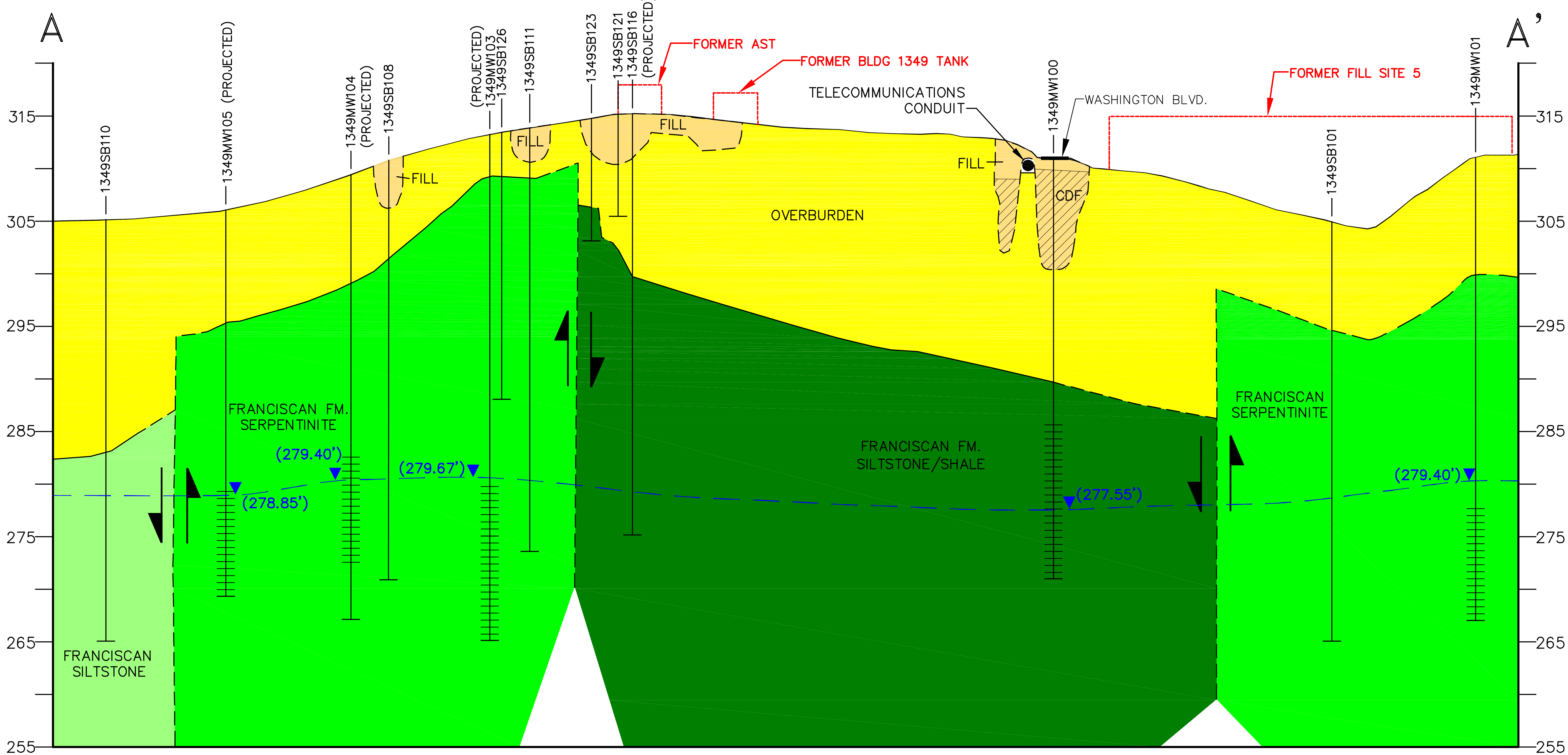
FIGURE
2-1

L: ON=*, OFF=REF*
P: PAGESET/PLT-BL1
1/4/05 SYR-85-DMW EAB DMW
32803002/3D/32803302.DWG



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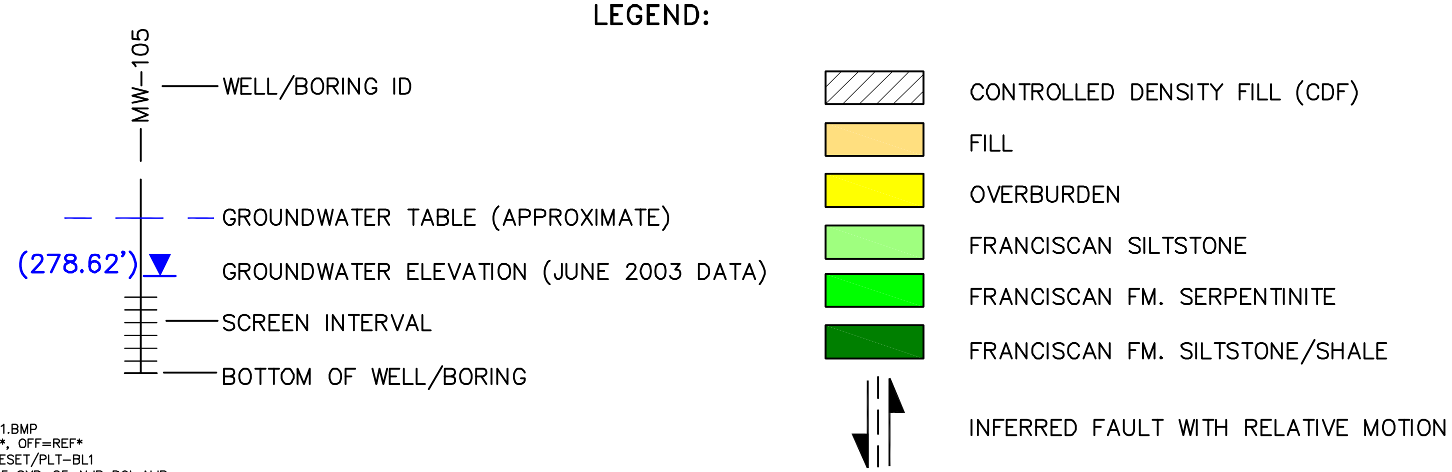

NOTE:

BORINGS SHOWN ON CROSS-SECTION ONLY INCLUDE PHASE 1 AND PHASE 2 BORINGS BY TREADWELL & ROLLO THAT FALL ON OR IN CLOSE PROXIMITY TO LINE A-A' AND EXTEND TO INTERPRETED BEDROCK OR INCLUDE RELEVANT CONTACTS BETWEEN FILL AND UNDISTURBED MATERIALS. SOME BORINGS PROJECTED ONTO LINE OF CROSS-SECTION, AS INDICATED, TO PROVIDE OVERBURDEN/BEDROCK CONTACT DATA WHERE NONE EXIST PROXIMATE TO LINE OF CROSS-SECTION.

0 30' 60'
APPROXIMATE HORIZONTAL SCALE

0 10' 20'
APPROXIMATE VERTICAL SCALE
(VERTICAL DATUM: PRESIDIO LOWER LOW WATER-FT PLLW)

I: PRES1.BMP
L: ON=*, OFF=REF*
P: PAGESET/PLT-BL1
2/28/05 SYR-85-NJR PGL NJR
32803002/32803V01.DWG

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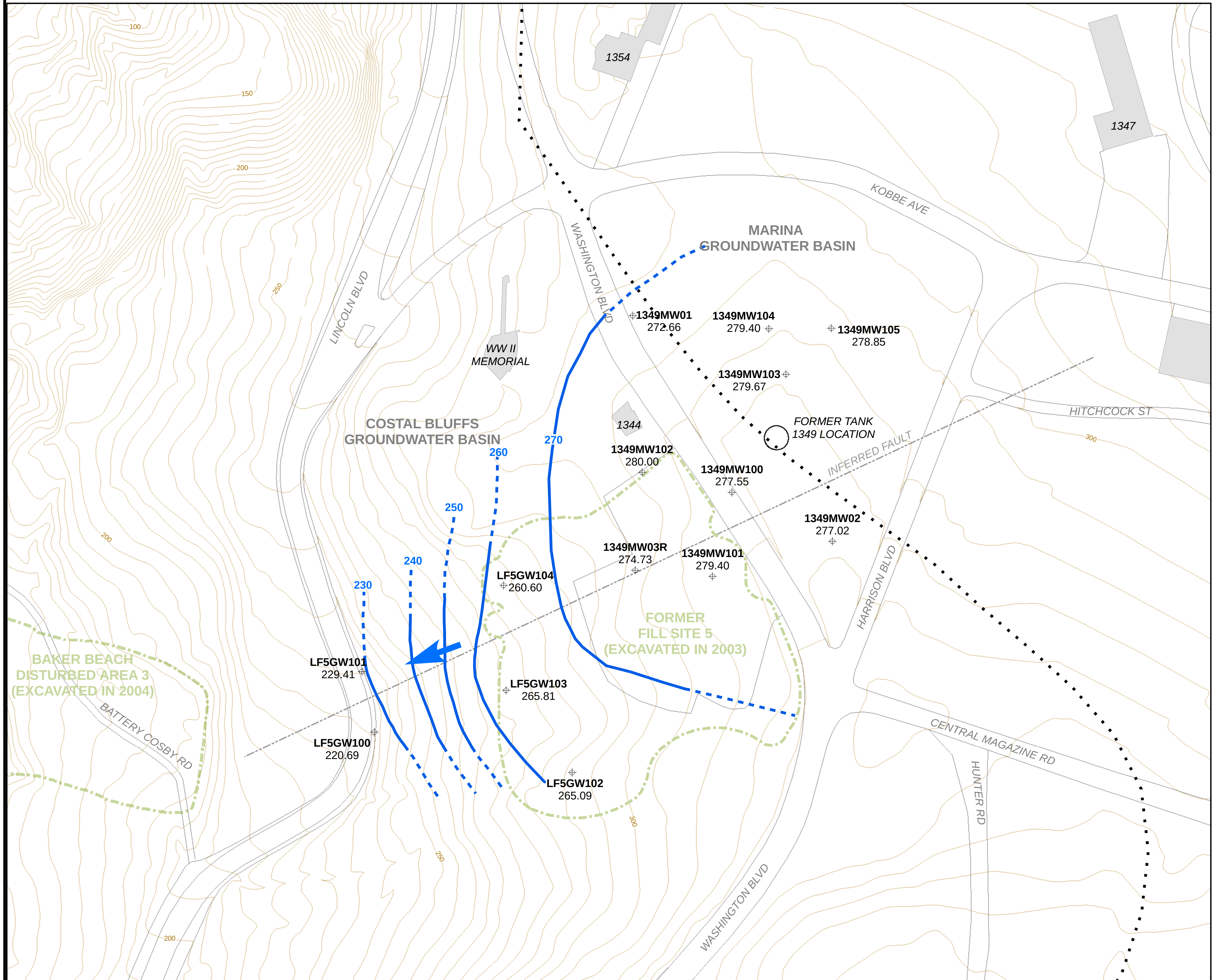
SAN FRANSISCO, CALIFORNIA
DRAFT CORRECTIVE ACTION PLAN BUILDING 1349 STUDY AREA

CONCEPTUAL STRATIGRAPHIC CROSS-SECTION A -A'

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE
2-2



LEGEND:

1349MW02 276.19 — GROUNDWATER MONITORING WELL MAY 2004 GROUNDWATER ELEVATION

APPROXIMATE DIRECTION OF GROUNDWATER FLOW

GROUNDWATER ELEVATION CONTOUR (CONTOUR INTERVAL: 10 FT) (DASHED WHERE INFERRED)

FORMER REMEDIATION SITE EXCAVATION BOUNDARY

GROUNDWATER BASIN BOUNDARY

INFERRED FAULT

TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL : 5 FT)

1344 — BUILDING AND NUMBER

NOTES:

1. GROUNDWATER ELEVATION DATA COLLECTED MAY 2004.
2. BASE MAP DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL & ROLLO, OCTOBER 2003.
3. LOCATION OF INFERRED FAULT FROM REVISED FEASIBILITY STUDY MAIN INSTALLATION SITES (EKI, 2003).
4. HORIZONTAL DATUM: NAD27, CA STATE PLANE COORDINATES, ZONE 3, FEET; VERTICAL DATUM: (TOPOGRAPHY) NORTH AMERICAN VERTICAL DATUM, NAVD88 (GROUNDWATER) PRESIDIO LOWER LOW WATER (FT. PLLW).

0 130 260 Feet

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GROUNDWATER ELEVATION CONTOUR MAP

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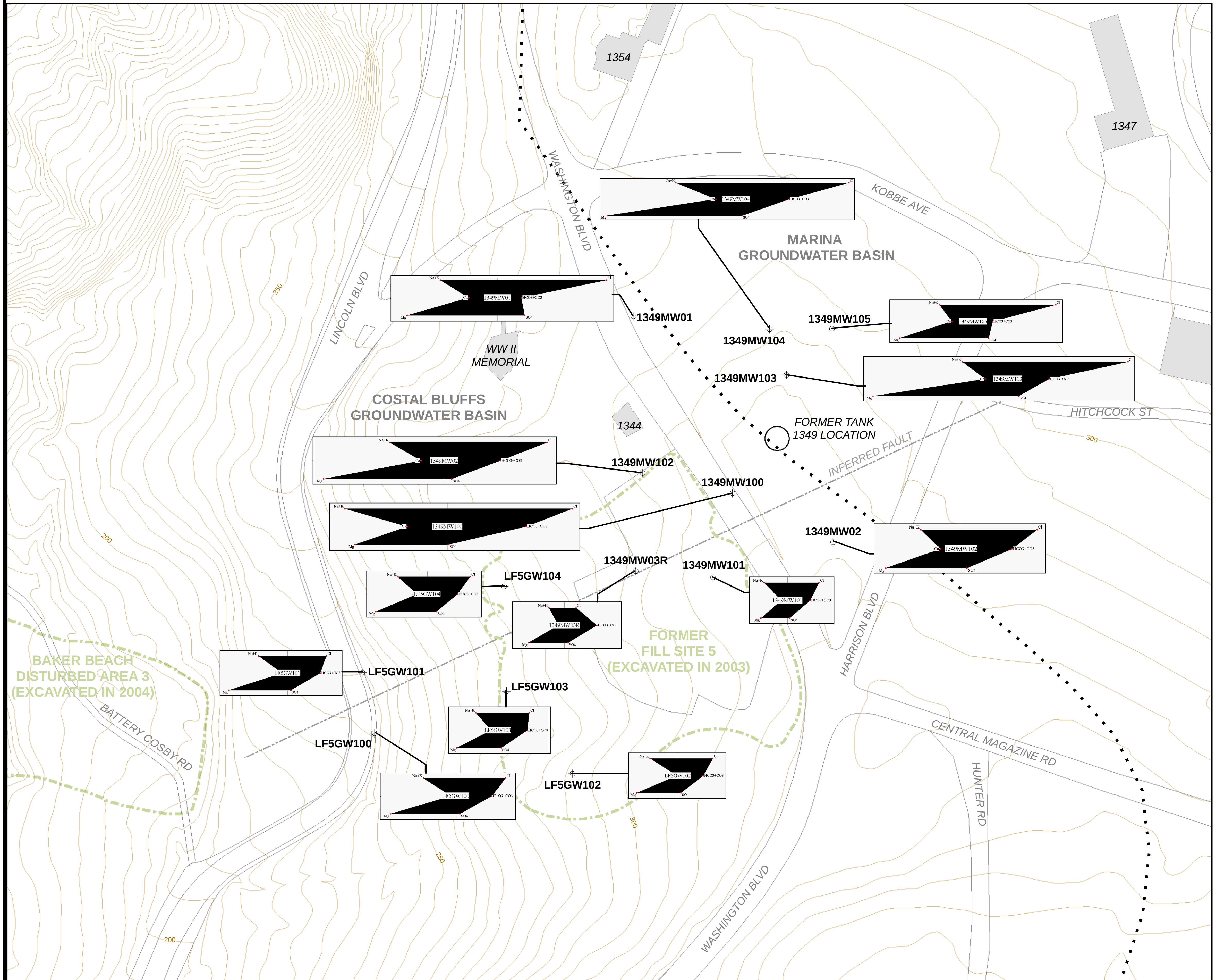
FIGURE 2-3

DRAFT

2/21/05 SYR-85 EAB
Presidio Trust- Building 1349
Q:/Presidio-Trust/C-A-P/mxd/GW-Elevation.mxd



LEGEND:

- 1349MW02 — GROUNDWATER MONITORING WELL WITH STIFF DIAGRAM OF CATION/ANION CONCENTRATIONS
- FORMER REMEDIATION SITE EXCAVATION BOUNDARY
- GROUNDWATER BASIN BOUNDARY
- INFERRED FAULT
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL : 5 FT)
- 1344 — BUILDING AND NUMBER

NOTES:

1. STIFF DIAGRAMS BASED ON A 0-25 meq/l CATION/ANION SCALE.
2. BASE MAP DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL & ROLLO, OCTOBER 2003.
3. LOCATION OF INFERRED FAULT FROM REVISED FEASIBILITY STUDY MAIN INSTALLATION SITES (EKI, 2003).
4. HORIZONTAL DATUM: NAD27, CA STATE PLANE COORDINATES, ZONE 3, FEET; VERTICAL DATUM: (TOPOGRAPHY) NORTH AMERICAN VERTICAL DATUM, NAVD88 (GROUNDWATER) PRESIDIO LOWER LOW WATER (FT. PLLW).

0 120 240 Feet

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DRAFT CORRECTIVE ACTION PLAN BUILDING 1349 STUDY AREA

STIFF DIAGRAMS SHOWING MAJOR CATION/ANION CONCENTRATION - MARCH 2004 DATA

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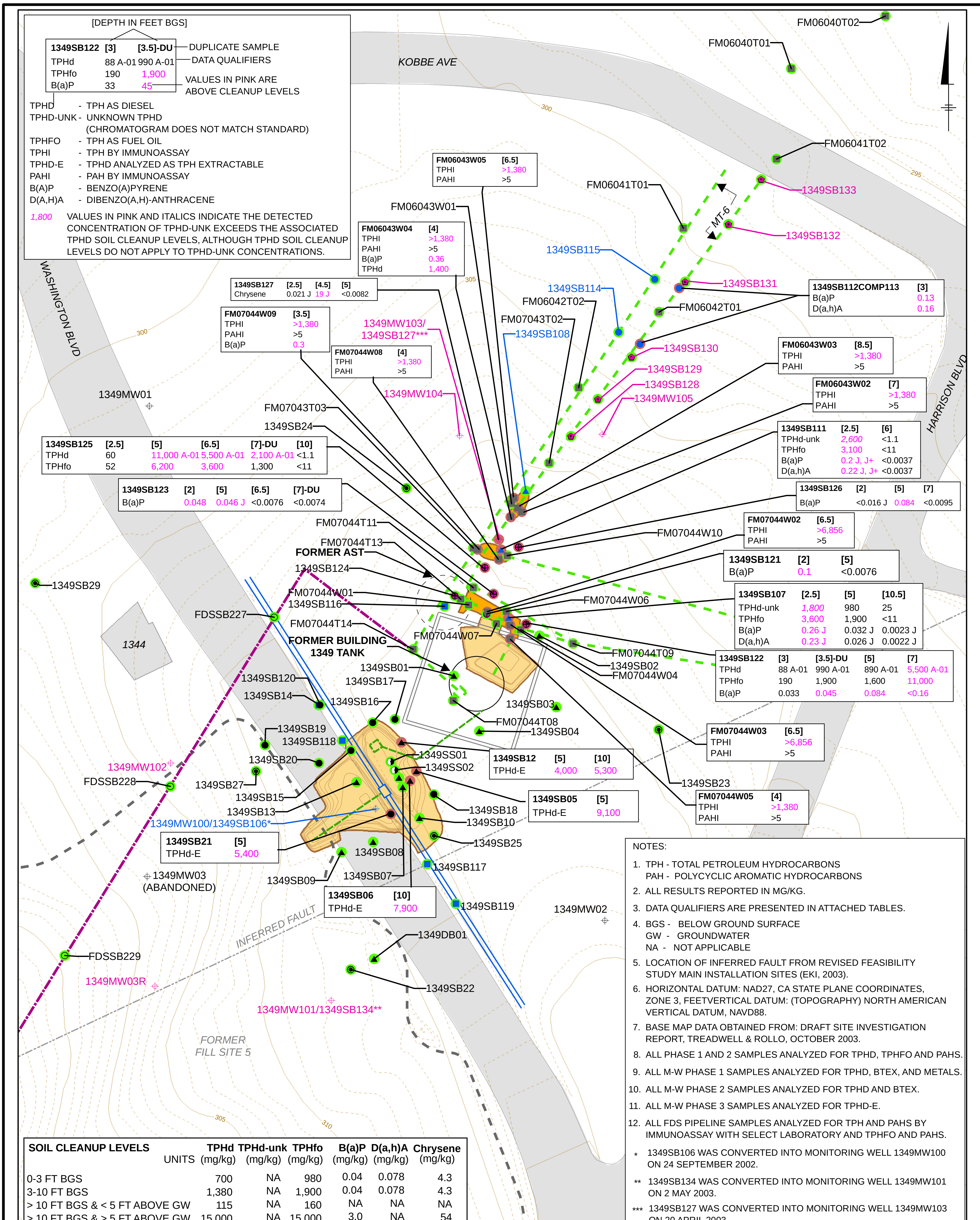
engineers, scientists, economists

FIGURE
2-3A

DRAFT

2/25/05 SYR-85 EAB
Presidio Trust- Building 1349
Q:/Presidio-Trust/C-A-P/mxd/Stiff-Diagrams.mxd



NOTES:

1. TPH - TOTAL PETROLEUM HYDROCARBONS
   PAH - POLYCYCLIC AROMATIC HYDROCARBONS
2. ALL RESULTS REPORTED IN MG/KG.
3. DATA QUALIFIERS ARE PRESENTED IN ATTACHED TABLES.
4. BGS - BELOW GROUND SURFACE
   GW - GROUNDWATER
   NA - NOT APPLICABLE
5. LOCATION OF INFERRED FAULT FROM REVISED FEASIBILITY STUDY MAIN INSTALLATION SITES (EKI, 2003).
6. HORIZONTAL DATUM: NAD27, CA STATE PLANE COORDINATES, ZONE 3, FEETVERTICAL DATUM: (TOPOGRAPHY) NORTH AMERICAN VERTICAL DATUM, NAVD88.
7. BASE MAP DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL & ROLLO, OCTOBER 2003.
8. ALL PHASE 1 AND 2 SAMPLES ANALYZED FOR TPHD, TPHFO AND PAHS.
9. ALL M-W PHASE 1 SAMPLES ANALYZED FOR TPHD, BTEX, AND METALS.
10. ALL M-W PHASE 2 SAMPLES ANALYZED FOR TPHD AND BTEX.
11. ALL M-W PHASE 3 SAMPLES ANALYZED FOR TPHD-E.
12. ALL FDS PIPELINE SAMPLES ANALYZED FOR TPH AND PAHS BY IMMUNOASSAY WITH SELECT LABORATORY AND TPHFO AND PAHS.

* 1349SB106 WAS CONVERTED INTO MONITORING WELL 1349MW100 ON 24 SEPTEMBER 2002.

** 1349SB134 WAS CONVERTED INTO MONITORING WELL 1349MW101 ON 2 MAY 2003.

*** 1349SB127 WAS CONVERTED INTO MONITORING WELL 1349MW103 ON 20 APRIL 2003.

SOIL CLEANUP LEVELS UNITS	TPHd (mg/kg)	TPHd-unk (mg/kg)	TPHfo (mg/kg)	B(a)P (mg/kg)	D(a,h)A (mg/kg)	Chrysene (mg/kg)
0-3 FT BGS	700	NA	980	0.04	0.078	4.3
3-10 FT BGS	1,380	NA	1,900	0.04	0.078	4.3
> 10 FT BGS & < 5 FT ABOVE GW	115	NA	160	NA	NA	NA
> 10 FT BGS & > 5 FT ABOVE GW	15,000	NA	15,000	3.0	NA	54

LEGEND:

- PREVIOUS INSTALLED GROUNDWATER MONITORING WELL

PHASE 1 LOCATIONS
- SOURCE-SPECIFIC SOIL BORING
- DOWNGRADIENT SOIL BORING
- CONFIRMATION HAND-AUGER SOIL BORING
- GROUNDWATER MONITORING WELL

PHASE 2 LOCATIONS
- SOIL BORING
- HAND AUGER SAMPLE
- GROUNDWATER MONITORING WELL
- VALUE ABOVE CLEAN-UP LEVEL
- VALUE BELOW CLEAN-UP LEVEL

HISTORIC SAMPLE LOCATIONS
- SOIL BORING LOCATION - PHASE 1 BY M-W
- SOIL BORING LOCATION - PHASE 2 BY M-W
- SOIL BORING LOCATION - PHASE 3 BY M-W
- SURFACE SOIL LOCATION - PHASE 3 BY M-W
- FDS PIPELINE SAMPLE LOCATION
- SOIL BORING LOCATION - FDS PIPELINE RELEASE ASSESSMENT

TOPOGRAPHIC CONTOURS
- (CONTOUR INTERVAL : 5 FT)
- (CONTOUR INTERVAL : 1 FT)
- FORMER FILL SITE 5 EXCAVATION BOUNDARY
- INFERRED FAULT

- FORMER BUILDING 1349 REMEDIAL EXCAVATION AREA (1995)
- FORMER FDS REMEDIAL EXCAVATIONS
- 1344 BUILDING AND NUMBER
- COMMUNICATIONS CONDUIT
- FORMER PIPE
- FORMER FDS PIPELINE TO BUILDING 1773
- FDS TRENCH EXCAVATION
- FORMER ABOVEGROUND STORAGE TANK (AST)
- FORMER BUILDING 1349 TANK
- FORMER SECONDARY CONTAINMENT

0 50 100 Feet

DRAFT

2/28/05 SYR-85 EAB
Presidio Trust- Building 1349
Q:/Presidio-Trust/C-A-P/mxd/TPAH-PAH-COC-Shallow.mxd

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DRAFT CORRECTIVE ACTION PLAN BUILDING 1349 STUDY AREA

COCs DETECTED IN SITE SHALLOW SOIL ABOVE CLEANUP LEVELS (0-10 FT BGS)

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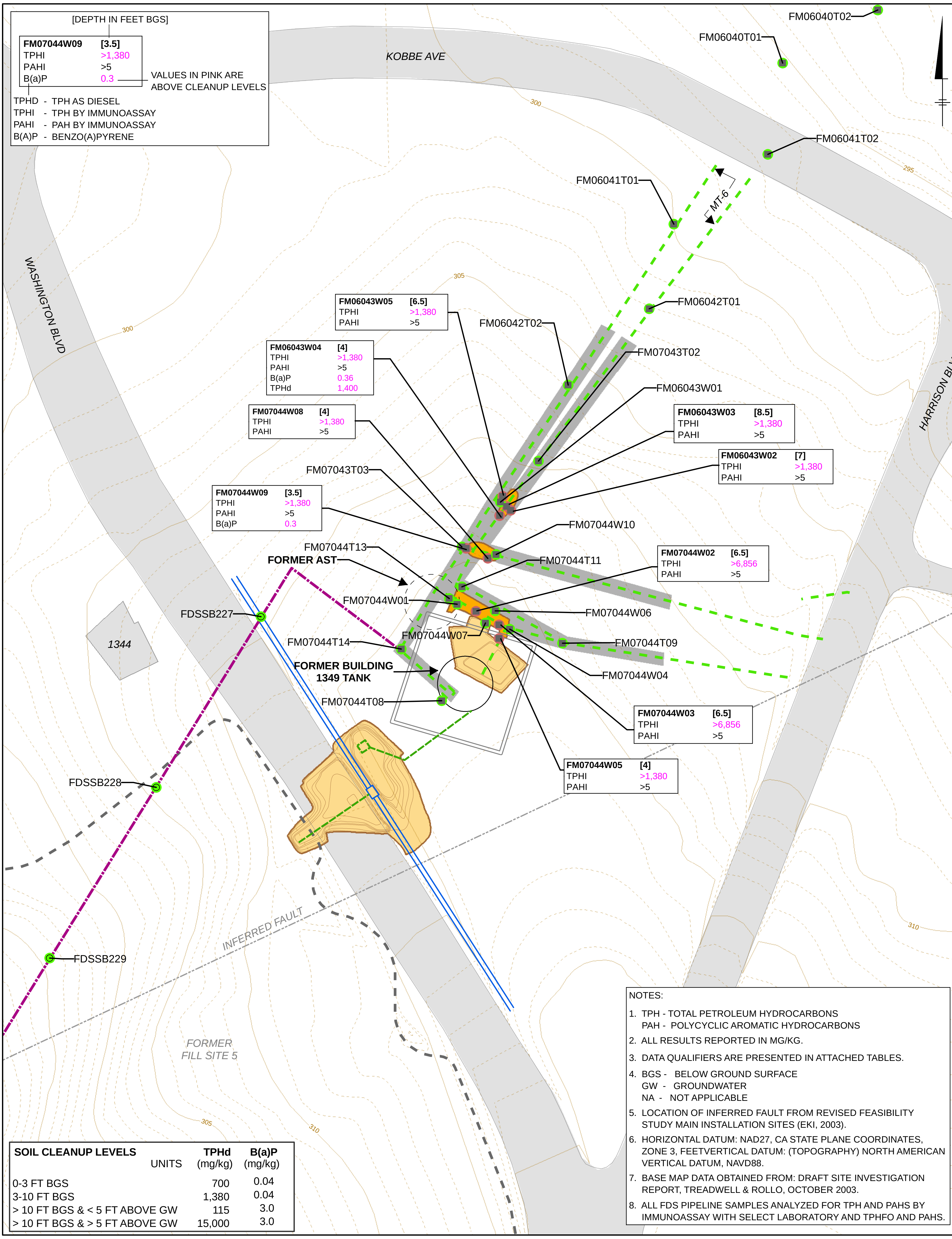
FIGURE 2-4



SOIL CLEANUP LEVELS

	UNITS	TPHd (mg/kg)	B(a)P (mg/kg)
0-3 FT BGS		700	0.04
3-10 FT BGS		1,380	0.04
> 10 FT BGS & < 5 FT ABOVE GW		115	3.0
> 10 FT BGS & > 5 FT ABOVE GW		15,000	3.0

NOTES:

1. TPH - TOTAL PETROLEUM HYDROCARBONS
   PAH - POLYCYCLIC AROMATIC HYDROCARBONS
2. ALL RESULTS REPORTED IN MG/KG.
3. DATA QUALIFIERS ARE PRESENTED IN ATTACHED TABLES.
4. BGS - BELOW GROUND SURFACE
   GW - GROUNDWATER
   NA - NOT APPLICABLE
5. LOCATION OF INFERRED FAULT FROM REVISED FEASIBILITY STUDY MAIN INSTALLATION SITES (EKI, 2003).
6. HORIZONTAL DATUM: NAD27, CA STATE PLANE COORDINATES, ZONE 3, FEETVERTICAL DATUM: (TOPOGRAPHY) NORTH AMERICAN VERTICAL DATUM, NAVD88.
7. BASE MAP DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL & ROLLO, OCTOBER 2003.
8. ALL FDS PIPELINE SAMPLES ANALYZED FOR TPH AND PAHS BY IMMUNOASSAY WITH SELECT LABORATORY AND TPHFO AND PAHS.

LEGEND:

- FDS PIPELINE SAMPLE LOCATION
- SOIL BORING LOCATION - FDS PIPELINE RELEASE ASSESSMENT
- VALUE ABOVE CLEAN-UP LEVEL
- VALUE BELOW CLEAN-UP LEVEL
- TOPOGRAPHIC CONTOURS
  - (CONTOUR INTERVAL : 5 FT)
  - (CONTOUR INTERVAL : 1 FT)
- FORMER FILL SITE 5 EXCAVATION BOUNDARY
- INFERRED FAULT
- COMMUNICATIONS CONDUIT
- FORMER PIPE
- FORMER FDS PIPELINE TO BUILDING 1773
- FDS TRENCH EXCAVATION
- FORMER FDS PIPE WITH ASSUMED LTTD SOIL FILL MATERIAL
- FORMER BUILDING 1349 REMEDIAL EXCAVATION AREA (1995)
- FORMER FDS REMEDIAL EXCAVATIONS
- 1344 BUILDING AND NUMBER
- FORMER ABOVEGROUND STORAGE TANK (AST)
- FORMER BUILDING 1349 TANK
- FORMER SECONDARY CONTAINMENT

0 50 100 Feet

THE PRESIDIO TRUST
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DRAFT CORRECTIVE ACTION PLAN BUILDING 1349 STUDY AREA

COCs DETECTED IN SITE SHALLOW SOIL AT FDS INVESTIGATION/EXCAVATION AREAS ABOVE CLEANUP LEVELS (0-10 FT BGS)

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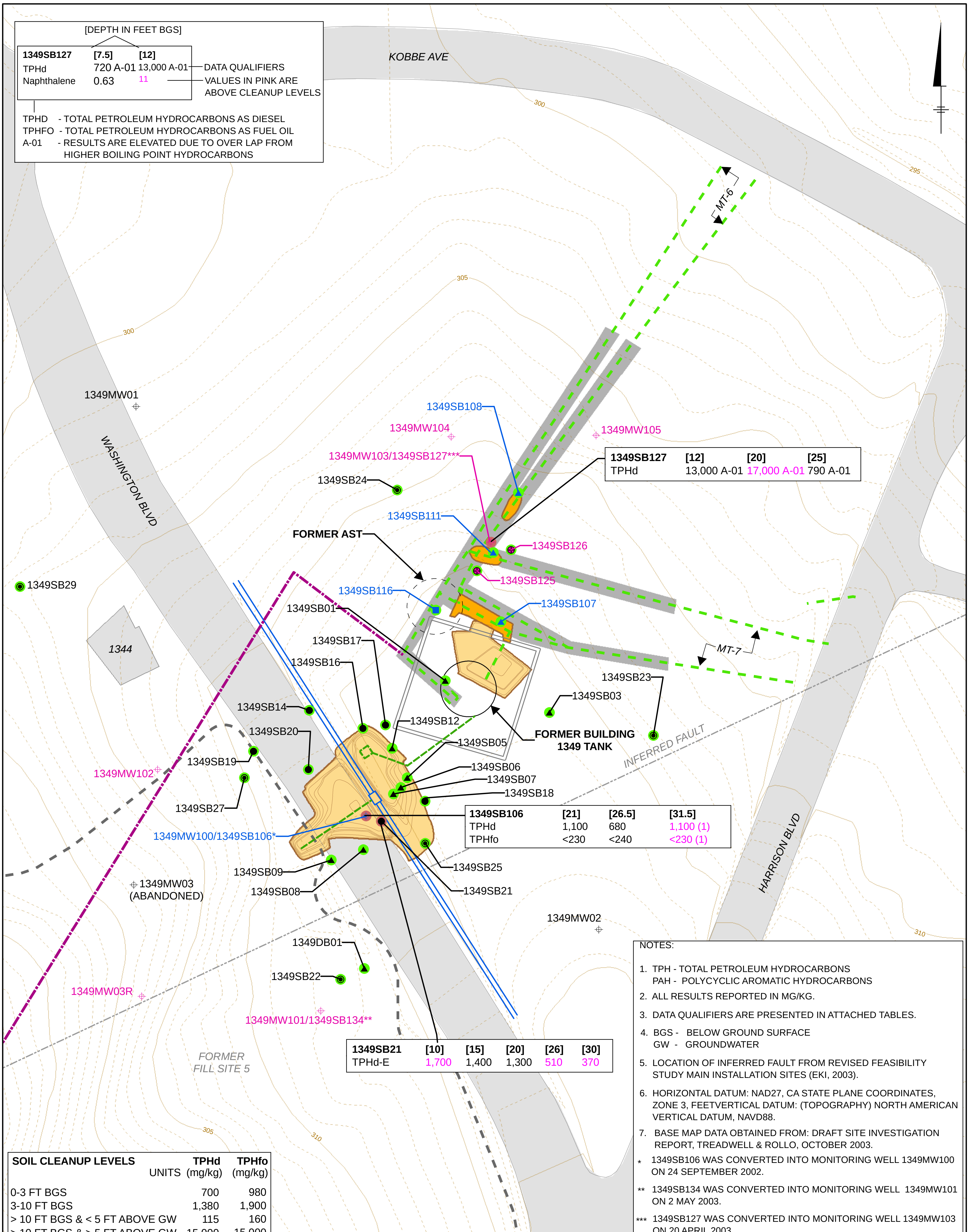
FIGURE 2-4A

DRAFT

2/21/05 SYR-85 EAB
Presidio Trust- Building 1349
Q:/Presidio-Trust/C-A-P/mxd/TPAH-PAH-COC-Shallow-FDS-areas.mxd



[DEPTH IN FEET BGS]

1349SB127	[7.5]	[12]
TPHd	720 A-01	13,000 A-01
Naphthalene	0.63	11

DATA QUALIFIERS
VALUES IN PINK ARE ABOVE CLEANUP LEVELS

TPHD - TOTAL PETROLEUM HYDROCARBONS AS DIESEL
TPHFO - TOTAL PETROLEUM HYDROCARBONS AS FUEL OIL
A-01 - RESULTS ARE ELEVATED DUE TO OVER LAP FROM HIGHER BOILING POINT HYDROCARBONS

1349SB127	[12]	[20]	[25]
TPHd	13,000 A-01	17,000 A-01	790 A-01

1349SB106	[21]	[26.5]	[31.5]
TPHd	1,100	680	1,100 (1)
TPHfo	<230	<240	<230 (1)

1349SB21	[10]	[15]	[20]	[26]	[30]
TPHd-E	1,700	1,400	1,300	510	370

SOIL CLEANUP LEVELS UNITS	TPHd (mg/kg)	TPHfo (mg/kg)
0-3 FT BGS	700	980
3-10 FT BGS	1,380	1,900
> 10 FT BGS & < 5 FT ABOVE GW	115	160
> 10 FT BGS & > 5 FT ABOVE GW	15,000	15,000

NOTES:

1. TPH - TOTAL PETROLEUM HYDROCARBONS
   PAH - POLYCYCLIC AROMATIC HYDROCARBONS
2. ALL RESULTS REPORTED IN MG/KG.
3. DATA QUALIFIERS ARE PRESENTED IN ATTACHED TABLES.
4. BGS - BELOW GROUND SURFACE
   GW - GROUNDWATER
5. LOCATION OF INFERRED FAULT FROM REVISED FEASIBILITY STUDY MAIN INSTALLATION SITES (EKI, 2003).
6. HORIZONTAL DATUM: NAD27, CA STATE PLANE COORDINATES, ZONE 3, FEETVERTICAL DATUM: (TOPOGRAPHY) NORTH AMERICAN VERTICAL DATUM, NAVD88.
7. BASE MAP DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL & ROLLO, OCTOBER 2003.

* 1349SB106 WAS CONVERTED INTO MONITORING WELL 1349MW100 ON 24 SEPTEMBER 2002.

** 1349SB134 WAS CONVERTED INTO MONITORING WELL 1349MW101 ON 2 MAY 2003.

*** 1349SB127 WAS CONVERTED INTO MONITORING WELL 1349MW103 ON 20 APRIL 2003.

LEGEND:

- GROUNDWATER MONITORING WELL

PHASE 1 LOCATIONS
- SOURCE-SPECIFIC SOIL BORING
- DOWNGRADIENT SOIL BORING
- GROUNDWATER MONITORING WELL

PHASE 2 LOCATIONS
- SOIL BORING
- GROUNDWATER MONITORING WELL

- VALUE ABOVE CLEAN-UP LEVEL
- VALUE BELOW CLEAN-UP LEVEL

HISTORIC SAMPLE LOCATIONS
- SOIL BORING LOCATION - PHASE 1 BY M-W
- SOIL BORING LOCATION - PHASE 2 BY M-W
- SOIL BORING LOCATION - PHASE 3 BY M-W

TOPOGRAPHIC CONTOURS
- (CONTOUR INTERVAL : 5 FT)
- (CONTOUR INTERVAL : 1 FT)
- COMMUNICATIONS CONDUIT
- FORMER PIPE
- FDS TRENCH EXCAVATION
- INFERRED FAULT
- FORMER FDS PIPELINE TO BUILDING 1773
- FORMER FILL SITE 5 EXCAVATION BOUNDARY

- FORMER ABOVEGROUND STORAGE TANK (AST)
- FORMER BUILDING 1349 TANK
- FORMER SECONDARY CONTAINMENT
- FORMER BUILDING 1349 REMEDIAL EXCAVATION AREA (1995)
- FORMER FDS REMEDIAL EXCAVATIONS
- 1344 BUILDING AND NUMBER
- FORMER FDS PIPE WITH ASSUMED LTTD SOIL FILL MATERIAL

DRAFT

0 50 100 Feet

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DRAFT CORRECTIVE ACTION PLAN BUILDING 1349 STUDY AREA

COCs DETECTED IN SITE DEEP SOIL ABOVE CLEANUP LEVELS (>10 FT BGS)

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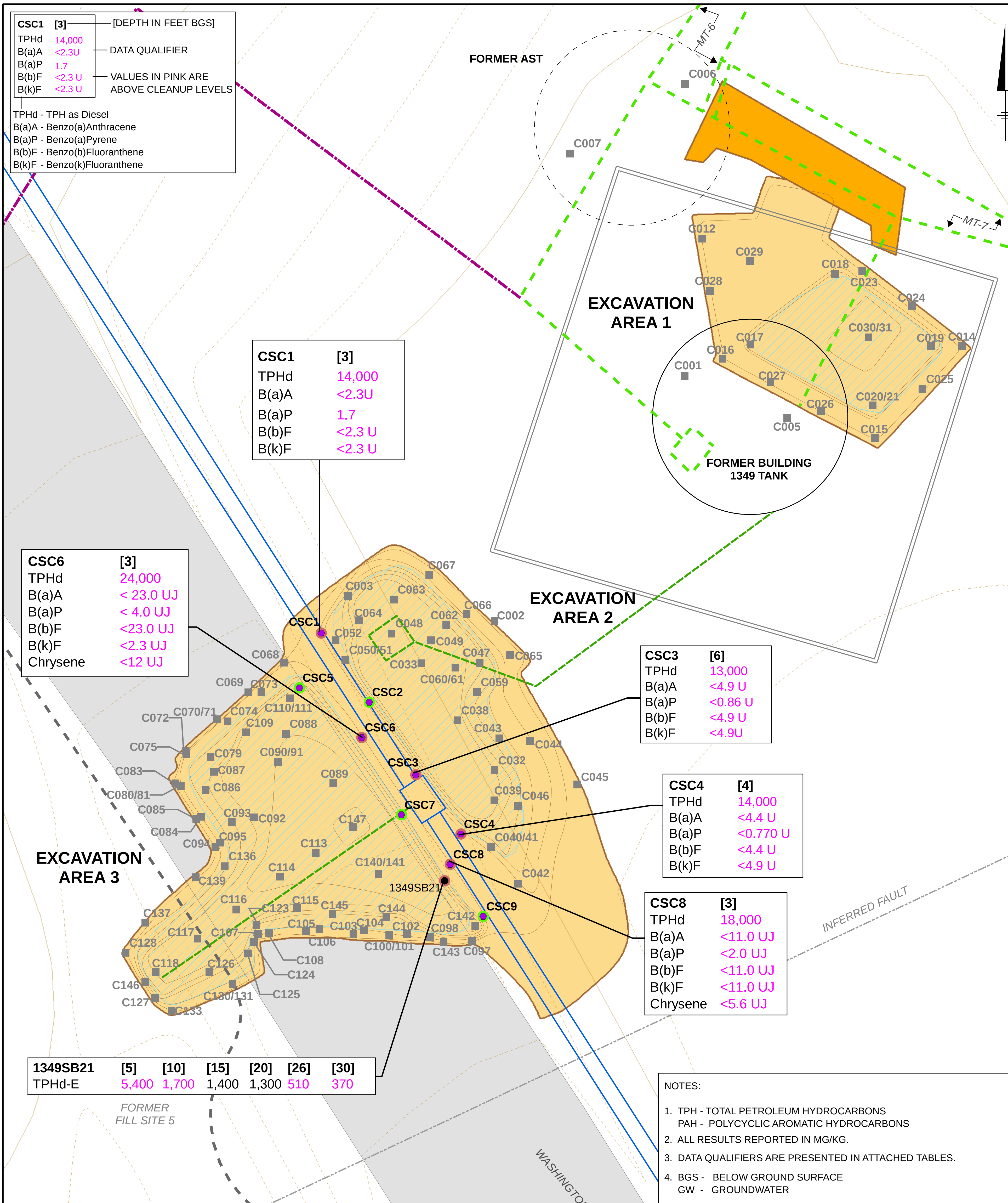
FIGURE 2-5

2/28/05 SYR-85 EAB
Presidio Trust- Building 1349
Q:/Presidio-Trust/C-A-P/mxd/TPAH-PAH-COC-Deep.mxd



SOIL CLEANUP LEVELS UNITS	TPHd (mg/kg)	B(a)A (mg/kg)	B(a)P (mg/kg)	B(b)F (mg/kg)	B(k)F (mg/kg)	Chrysene (mg/kg)
0-3 FT BGS	700	0.43	0.04	0.43	0.43	4.3
3-10 FT BGS	1,380	0.43	0.04	0.43	0.43	4.3
> 10 FT BGS & < 5 FT ABOVE GW	115	8.0	3.0	23.0	23.0	54.0
> 10 FT BGS & > 5 FT ABOVE GW	15,000	8.0	3.0	23.0	23.0	54.0

NOTES:

1. TPH - TOTAL PETROLEUM HYDROCARBONS
   PAH - POLYCYCLIC AROMATIC HYDROCARBONS
2. ALL RESULTS REPORTED IN MG/KG.
3. DATA QUALIFIERS ARE PRESENTED IN ATTACHED TABLES.
4. BGS - BELOW GROUND SURFACE
   GW - GROUNDWATER
5. LOCATION OF INFERRED FAULT FROM REVISED FEASIBILITY STUDY MAIN INSTALLATION SITES (EKI, 2003).
6. HORIZONTAL DATUM: NAD27, CA STATE PLANE COORDINATES, ZONE 3, FEET; VERTICAL DATUM: (TOPOGRAPHY) NORTH AMERICAN VERTICAL DATUM, NAVD88.
7. BASE MAP DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL & ROLLO, OCTOBER 2003.

LEGEND:

- CONDUIT SUPPORT COLUMN SAMPLE
- ARMY CONFIRMATION SAMPLE
- HISTORIC SOIL BORING LOCATION - PHASE 1 BY M-W
- VALUE ABOVE CLEAN-UP LEVEL
- VALUE BELOW CLEAN-UP LEVEL
- COMMUNICATIONS CONDUIT
- FORMER PIPE
- FDS TRENCH EXCAVATION
- INFERRED FAULT
- FORMER FDS PIPELINE TO BUILDING 1773
- FORMER FILL SITE 5 EXCAVATION BOUNDARY
- TOPOGRAPHIC CONTOURS
  (CONTOUR INTERVAL : 5 FT)
  (CONTOUR INTERVAL : 1 FT)
- FORMER ABOVEGROUND STORAGE TANK (AST)
- FORMER BUILDING 1349 TANK
- FORMER SECONDARY CONTAINMENT
- FORMER BUILDING 1349 REMEDIAL EXCAVATION AREA (1995)
- FORMER FDS REMEDIAL EXCAVATIONS
- APPROXIMATE LOCATION OF CONTROLLED DENSITY FILL

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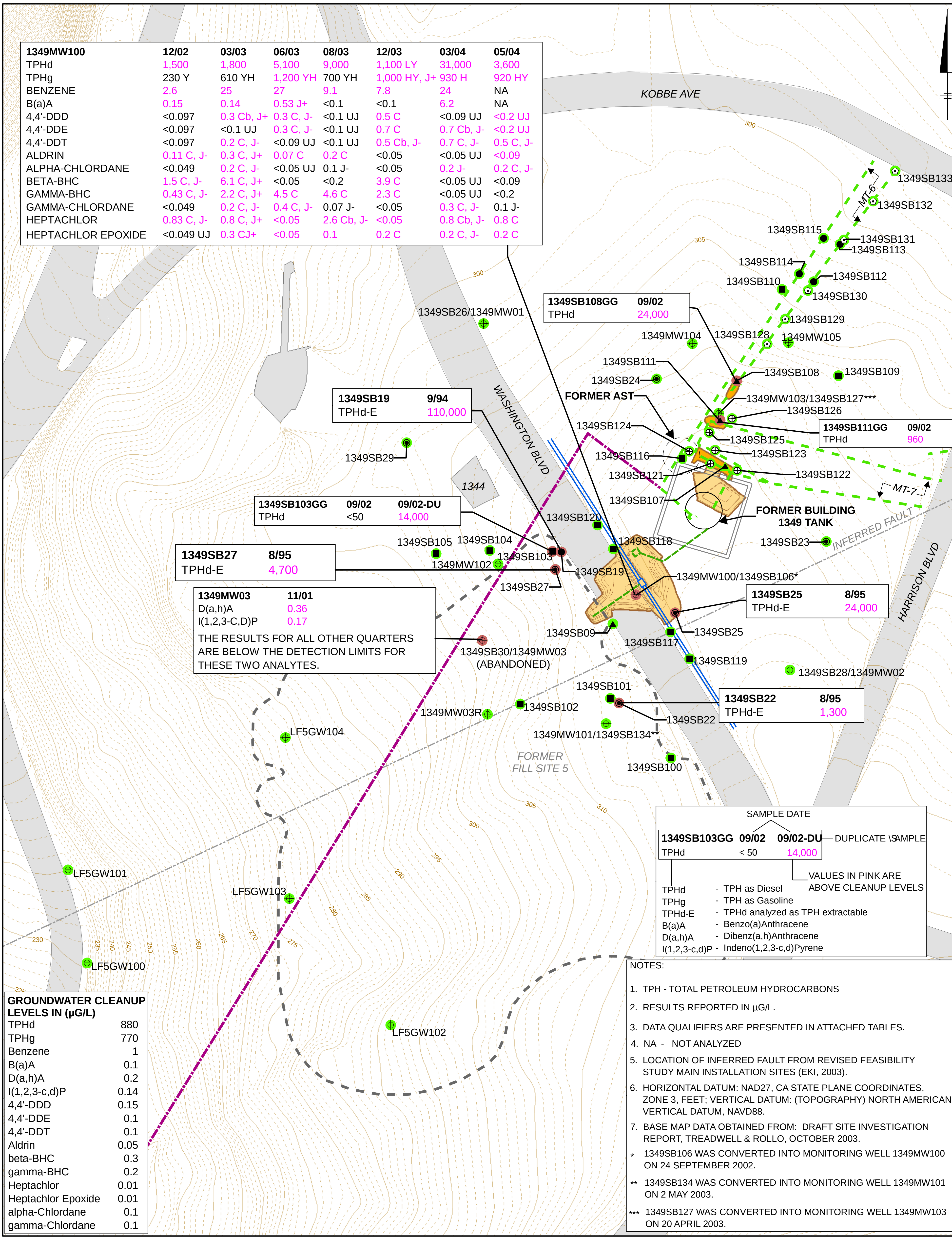
COCs DETECTED IN SITE SOIL BENEATH TELECOMMUNICATIONS CONDUIT

BLASLAND, BOUCK & LEE, INC.
engineers, scientists, economists

FIGURE 2-6

DRAFT

2/28/05 SYR-85 EAB
Presidio Trust- Building 1349
Q:/Presidio-Trust/C-A-P/mxd/TPAH-PAH-COC-under-comm-conduits.mxd



1349MW100	12/02	03/03	06/03	08/03	12/03	03/04	05/04
TPHd	1,500	1,800	5,100	9,000	1,100 LY	31,000	3,600
TPHg	230 Y	610 YH	1,200 YH	700 YH	1,000 HY, J+	930 H	920 HY
BENZENE	2.6	25	27	9.1	7.8	24	NA
B(a)A	0.15	0.14	0.53 J+	<0.1	<0.1	6.2	NA
4,4'-DDD	<0.097	0.3 Cb, J+	0.3 C, J-	<0.1 UJ	0.5 C	<0.09 UJ	<0.2 UJ
4,4'-DDE	<0.097	<0.1 UJ	0.3 C, J-	<0.1 UJ	0.7 C	0.7 Cb, J-	<0.2 UJ
4,4'-DDT	<0.097	0.2 C, J-	<0.09 UJ	<0.1 UJ	0.5 Cb, J-	0.7 C, J-	0.5 C, J-
ALDRIN	0.11 C, J-	0.3 C, J+	0.07 C	0.2 C	<0.05	<0.05 UJ	<0.09
ALPHA-CHLORDANE	<0.049	0.2 C, J-	<0.05 UJ	0.1 J-	<0.05	0.2 J-	0.2 C, J-
BETA-BHC	1.5 C, J-	6.1 C, J+	<0.05	<0.2	3.9 C	<0.05 UJ	<0.09
GAMMA-BHC	0.43 C, J-	2.2 C, J+	4.5 C	4.6 C	2.3 C	<0.05 UJ	<0.2
GAMMA-CHLORDANE	<0.049	0.2 C, J-	0.4 C, J-	0.07 J-	<0.05	0.3 C, J-	0.1 J-
HEPTACHLOR	0.83 C, J-	0.8 C, J+	<0.05	2.6 Cb, J-	<0.05	0.8 Cb, J-	0.8 C
HEPTACHLOR EPOXIDE	<0.049 UJ	0.3 CJ+	<0.05	0.1	0.2 C	0.2 C, J-	0.2 C

1349SB108GG	09/02
TPHd	24,000

1349SB19	9/94
TPHd-E	110,000

1349SB111GG	09/02
TPHd	960

1349SB103GG	09/02	09/02-DU
TPHd	<50	14,000

1349SB27	8/95
TPHd-E	4,700

1349SB25	8/95
TPHd-E	24,000

1349MW03	11/01
D(a,h)A	0.36
I(1,2,3-C,D)P	0.17

THE RESULTS FOR ALL OTHER QUARTERS ARE BELOW THE DETECTION LIMITS FOR THESE TWO ANALYTES.

1349SB22	8/95
TPHd-E	1,300

SAMPLE DATE

1349SB103GG	09/02	09/02-DU
TPHd	< 50	14,000

DUPLICATE SAMPLE

VALUES IN PINK ARE ABOVE CLEANUP LEVELS

- TPHd - TPH as Diesel
- TPHg - TPH as Gasoline
- TPHd-E - TPHd analyzed as TPH extractable
- B(a)A - Benzo(a)Anthracene
- D(a,h)A - Dibenz(a,h)Anthracene
- I(1,2,3-c,d)P - Indeno(1,2,3-c,d)Pyrene

GROUNDWATER CLEANUP LEVELS IN (µG/L)	
TPHd	880
TPHg	770
Benzene	1
B(a)A	0.1
D(a,h)A	0.2
I(1,2,3-c,d)P	0.14
4,4'-DDD	0.15
4,4'-DDE	0.1
4,4'-DDT	0.1
Aldrin	0.05
beta-BHC	0.3
gamma-BHC	0.2
Heptachlor	0.01
Heptachlor Epoxide	0.01
alpha-Chlordane	0.1
gamma-Chlordane	0.1

NOTES:

1. TPH - TOTAL PETROLEUM HYDROCARBONS
2. RESULTS REPORTED IN µG/L.
3. DATA QUALIFIERS ARE PRESENTED IN ATTACHED TABLES.
4. NA - NOT ANALYZED
5. LOCATION OF INFERRED FAULT FROM REVISED FEASIBILITY STUDY MAIN INSTALLATION SITES (EKI, 2003).
6. HORIZONTAL DATUM: NAD27, CA STATE PLANE COORDINATES, ZONE 3, FEET; VERTICAL DATUM: (TOPOGRAPHY) NORTH AMERICAN VERTICAL DATUM, NAVD88.
7. BASE MAP DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL & ROLLO, OCTOBER 2003.

* 1349SB106 WAS CONVERTED INTO MONITORING WELL 1349MW100 ON 24 SEPTEMBER 2002.

** 1349SB134 WAS CONVERTED INTO MONITORING WELL 1349MW101 ON 2 MAY 2003.

*** 1349SB127 WAS CONVERTED INTO MONITORING WELL 1349MW103 ON 20 APRIL 2003.

LEGEND:

- GROUNDWATER MONITORING WELL

PHASE 1 LOCATIONS
- SOURCE-SPECIFIC SOIL BORING
- DOWNGRADIENT SOIL BORING
- CONFIRMATION HAND-AUGER SOIL BORING

PHASE 2 LOCATIONS
- SOIL BORING
- HAND AUGER SAMPLE

- COMMUNICATIONS CONDUIT
- FORMER PIPE
- FDS TRENCH EXCAVATION
- INFERRED FAULT
- FORMER FDS PIPELINE TO BUILDING 1773
- FORMER FILL SITE 5 EXCAVATION BOUNDARY
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL : 5 FT) (CONTOUR INTERVAL : 1 FT)
- VALUE ABOVE CLEAN-UP LEVEL
- VALUE BELOW CLEAN-UP LEVEL
- NOT DETECTED
- FORMER ABOVEGROUND STORAGE TANK (AST)
- FORMER BUILDING 1349 TANK
- FORMER SECONDARY CONTAINMENT
- FORMER BUILDING 1349 REMEDIAL EXCAVATION AREA (1995)
- FORMER FDS REMEDIAL EXCAVATIONS
- 1344 BUILDING AND NUMBER

0 75 150 Feet

2/28/05 SYR-85 EAB
Presidio Trust- Building 1349
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COCs DETECTED IN SITE GROUNDWATER ABOVE CLEANUP LEVELS

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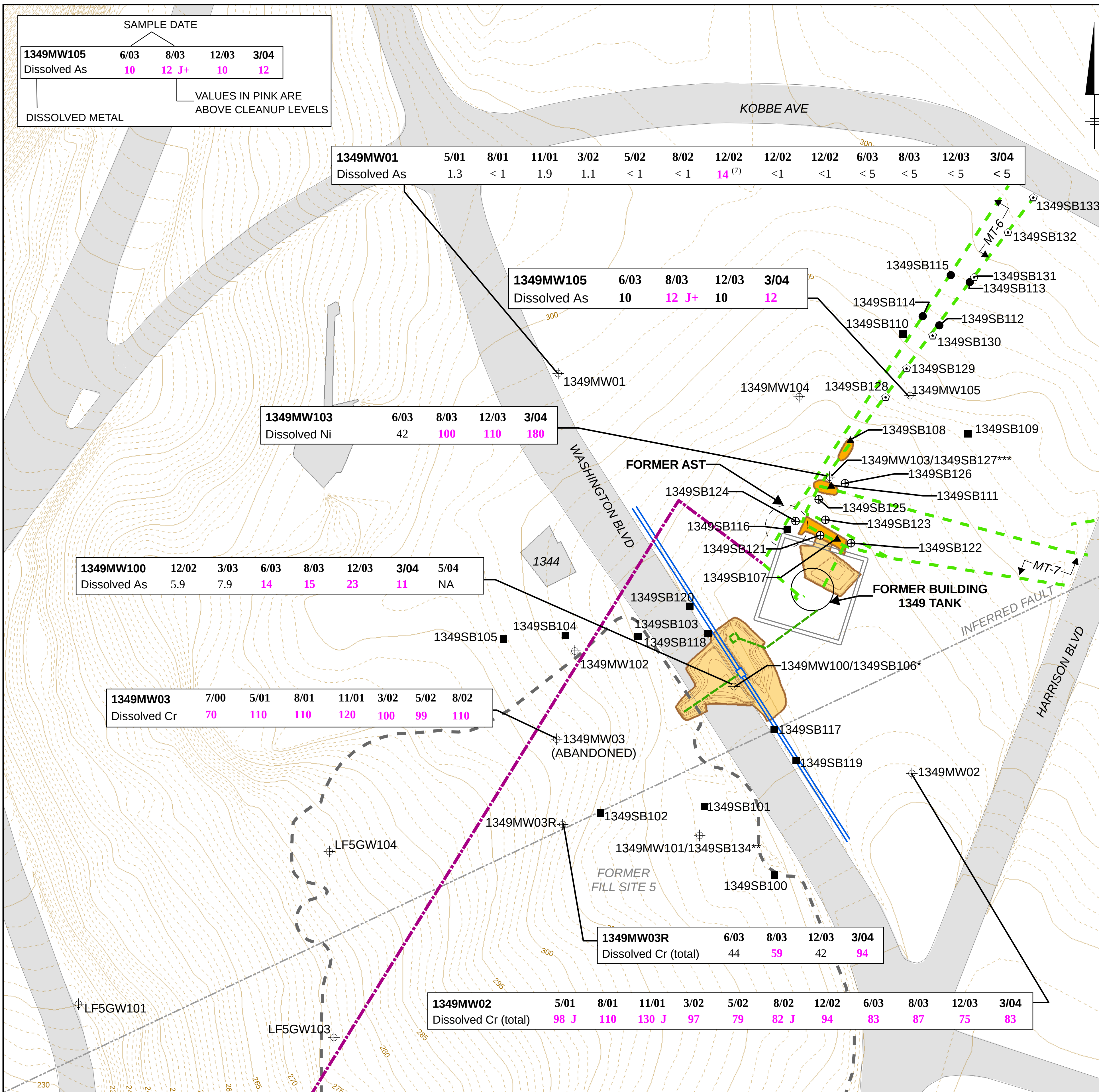
FIGURE 2-7



GROUNDWATER CLEANUP LEVELS IN µg/L

Dissolved Cr (total)	50
Dissolved Ni	100
Dissolved As	10

NOTES:

1. RESULTS REPORTED IN µg/L.
2. DATA QUALIFIERS ARE PRESENTED IN ATTACHED TABLES.
3. NA - NOT ANALYZED
4. LOCATION OF INFERRED FAULT FROM REVISED FEASIBILITY STUDY MAIN INSTALLATION SITES (EKI, 2003).
5. HORIZONTAL DATUM: NAD27, CA STATE PLANE COORDINATES, ZONE 3, FEET; VERTICAL DATUM: (TOPOGRAPHY) NORTH AMERICAN VERTICAL DATUM, NAVD88.
6. BASE MAP DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL & ROLLO, OCTOBER 2003.
7. ARSENIC DATA OBTAINED FROM LABORATORY CONTROL SAMPLE. THE ASSOCIATED PRIMARY SAMPLE AND BLIND DUPLICATE SAMPLE RESULTS WERE BOTH <1 µg/L.

* 1349SB106 WAS CONVERTED INTO MONITORING WELL 1349MW100 ON 24 SEPTEMBER 2002.

** 1349SB134 WAS CONVERTED INTO MONITORING WELL 1349MW101 ON 2 MAY 2003.

*** 1349SB127 WAS CONVERTED INTO MONITORING WELL 1349MW103 ON 20 APRIL 2003.

LEGEND:

- GROUNDWATER MONITORING WELL
- PHASE 1 LOCATIONS
- SOURCE-SPECIFIC SOIL BORING
- DOWNGRADIENT SOIL BORING
- CONFIRMATION HAND-AUGER SOIL BORING
- PHASE 2 LOCATIONS
- SOIL BORING
- HAND AUGER SAMPLE
- COMMUNICATIONS CONDUIT
- FORMER PIPE
- FDS TRENCH EXCAVATION
- INFERRED FAULT
- FORMER FDS PIPELINE TO BUILDING 1773
- FORMER FILL SITE 5 EXCAVATION BOUNDARY
- TOPOGRAPHIC CONTOURS (CONTOUR INTERVAL : 5 FT) (CONTOUR INTERVAL : 1 FT)
- FORMER ABOVEGROUND STORAGE TANK (AST)
- FORMER BUILDING 1349 TANK
- FORMER SECONDARY CONTAINMENT
- FORMER BUILDING 1349 REMEDIAL EXCAVATION AREA (1995)
- FORMER FDS REMEDIAL EXCAVATIONS
- 1344 BUILDING AND NUMBER

0 75 150 Feet

2/28/05 SYR-85 EAB
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Q:/Presidio-Trust/C-A-P/mxd/Dissolved-Metals.mxd

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DISSOLVED METALS DETECTED IN SITE GROUNDWATER ABOVE CLEANUP LEVELS

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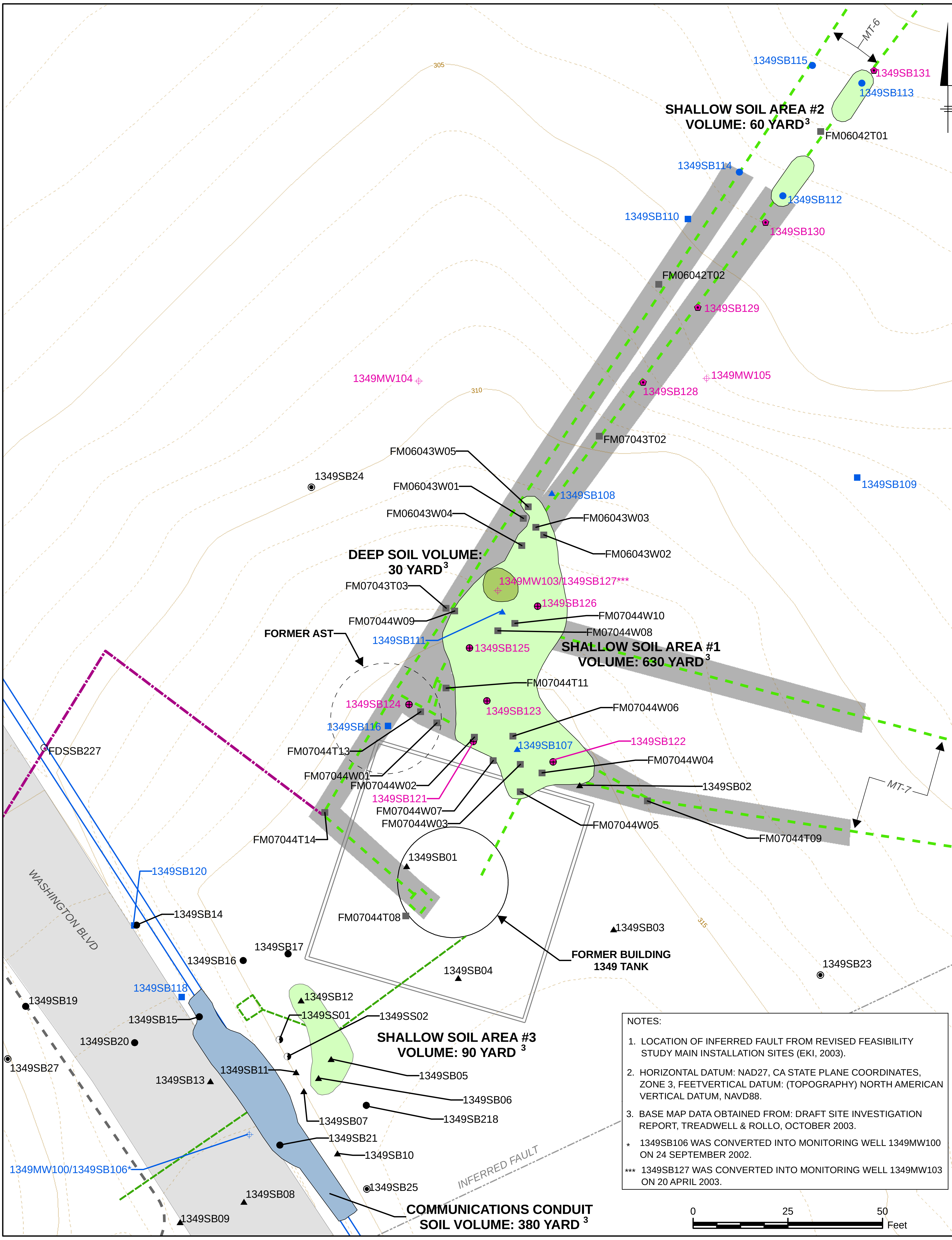
FIGURE 2-8



NOTES:

1. LOCATION OF INFERRED FAULT FROM REVISED FEASIBILITY STUDY MAIN INSTALLATION SITES (EKI, 2003).
2. HORIZONTAL DATUM: NAD27, CA STATE PLANE COORDINATES, ZONE 3, FEETVERTICAL DATUM: (TOPOGRAPHY) NORTH AMERICAN VERTICAL DATUM, NAVD88.
3. BASE MAP DATA OBTAINED FROM: DRAFT SITE INVESTIGATION REPORT, TREADWELL & ROLLO, OCTOBER 2003.

* 1349SB106 WAS CONVERTED INTO MONITORING WELL 1349MW100 ON 24 SEPTEMBER 2002.

*** 1349SB127 WAS CONVERTED INTO MONITORING WELL 1349MW103 ON 20 APRIL 2003.

LEGEND:

- PREVIOUS INSTALLED GROUNDWATER MONITORING WELL

PHASE 1 LOCATIONS
- SOURCE-SPECIFIC SOIL BORING
- DOWNGRADIENT SOIL BORING
- CONFIRMATION HAND-AUGER SOIL BORING
- GROUNDWATER MONITORING WELL

PHASE 2 LOCATIONS
- SOIL BORING
- HAND AUGER SAMPLE
- GROUNDWATER MONITORING WELL

HISTORIC SAMPLE LOCATIONS
- SOIL BORING LOCATION - PHASE 1 BY M-W
- SOIL BORING LOCATION - PHASE 2 BY M-W
- SOIL BORING LOCATION - PHASE 3 BY M-W
- SURFACE SOIL LOCATION - PHASE 3 BY M-W
- FDS PIPELINE SAMPLE LOCATION
- SOIL BORING LOCATION - FDS PIPELINE RELEASE ASSESSMENT

TOPOGRAPHIC CONTOURS
- (CONTOUR INTERVAL : 5 FT)
- (CONTOUR INTERVAL : 1 FT)

- APPROXIMATE EXTENT OF SOIL EXCEEDANCES IN DEEP SOIL
- APPROXIMATE EXTENT OF SOIL EXCEEDANCES IN SHALLOW SOIL
- COMMUNICATIONS CONDUIT
- FORMER PIPE
- FDS TRENCH EXCAVATION
- INFERRED FAULT
- FORMER FDS PIPELINE TO BUILDING 1773
- FORMER FILL SITE 5 EXCAVATION BOUNDARY
- FORMER ABOVEGROUND STORAGE TANK (AST)
- FORMER BUILDING 1349 TANK
- FORMER SECONDARY CONTAINMENT
- 1344 BUILDING AND NUMBER
- APPROXIMATE EXTENT OF SOIL EXCEEDANCES BENEATH COMMUNICATIONS CONDUIT
- FORMER FDS PIPE WITH ASSUMED LTTD SOIL FILL MATERIAL

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SUMMARY OF SOIL REMEDIAL UNITS

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FIGURE 3-1

2/18/05 SYR-85 EAB
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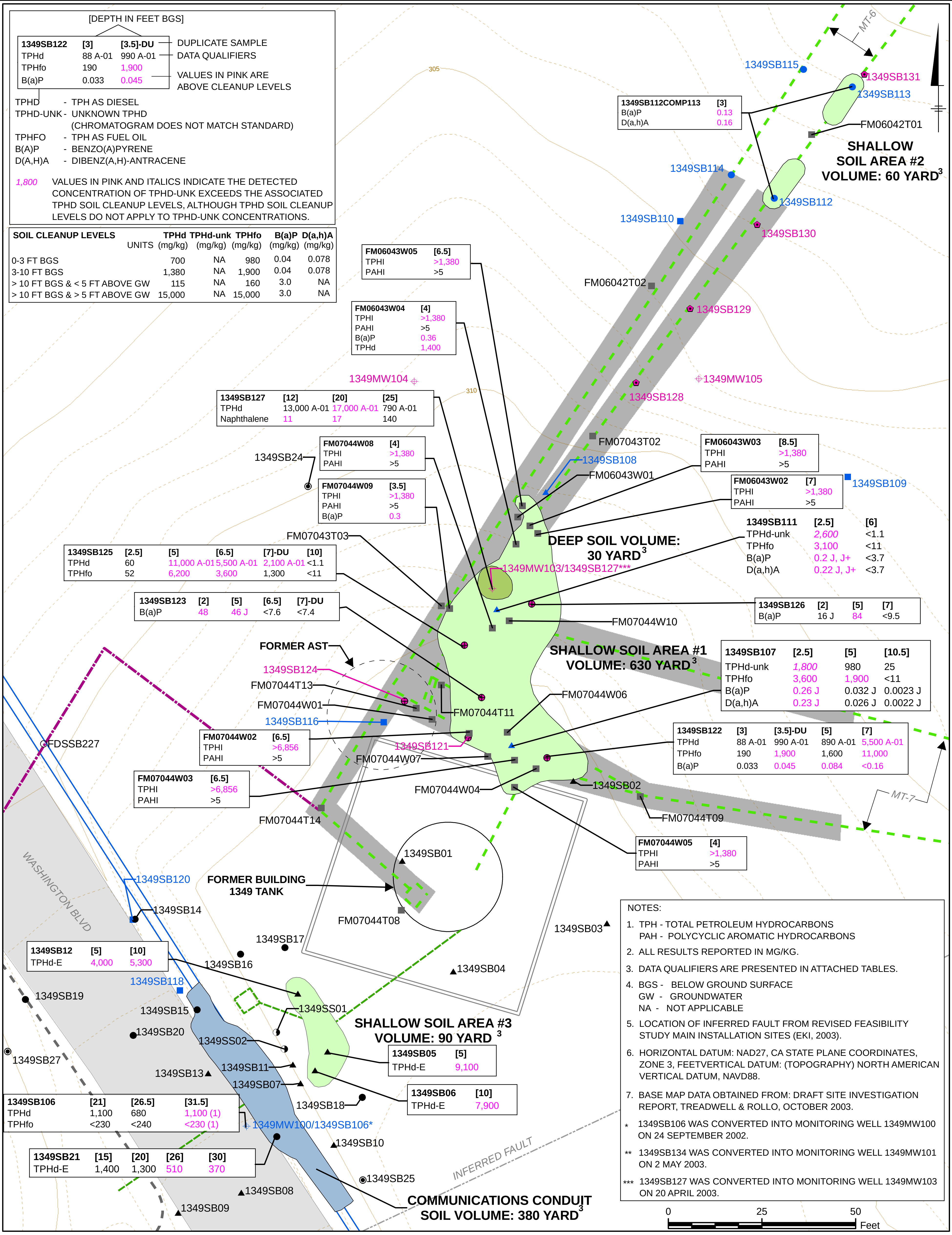
Q:/Presidio-Trust/C-A-P/mxd/summary-soil-remedial-units.mxd



LEGEND:

- PREVIOUSLY INSTALLED GROUNDWATER MONITORING WELL

PHASE 1 LOCATIONS
- SOURCE-SPECIFIC SOIL BORING
- DOWNGRADIENT SOIL BORING
- CONFIRMATION HAND-AUGER SOIL BORING
- GROUNDWATER MONITORING WELL

PHASE 2 LOCATIONS
- SOIL BORING
- HAND AUGER SAMPLE
- GROUNDWATER MONITORING WELL

HISTORIC SAMPLE LOCATIONS
- SOIL BORING LOCATION - PHASE 1 BY M-W
- SOIL BORING LOCATION - PHASE 2 BY M-W
- SOIL BORING LOCATION - PHASE 3 BY M-W
- SURFACE SOIL LOCATION - PHASE 3 BY M-W
- FDS PIPELINE SAMPLE LOCATION
- SOIL BORING LOCATION - FDS PIPELINE RELEASE ASSESSMENT

TOPOGRAPHIC CONTOURS
- (CONTOUR INTERVAL : 5 FT)
- (CONTOUR INTERVAL : 1 FT)
- APPROXIMATE EXTENT OF SOIL EXCEEDANCES IN DEEP SOIL
- APPROXIMATE EXTENT OF SOIL EXCEEDANCES IN SHALLOW SOIL

- COMMUNICATIONS CONDUIT
- FORMER PIPE
- FDS TRENCH EXCAVATION
- INFERRED FAULT
- FORMER FDS PIPELINE TO BUILDING 1773
- FORMER FILL SITE 5 EXCAVATION BOUNDARY
- FORMER ABOVEGROUND STORAGE TANK (AST)
- FORMER BUILDING 1349 TANK
- FORMER SECONDARY CONTAINMENT

- 1344 BUILDING AND NUMBER
- APPROXIMATE EXTENT OF SOIL EXCEEDANCES BENEATH COMMUNICATIONS CONDUIT
- FORMER FDS PIPE WITH ASSUMED LTTD SOIL FILL MATERIAL

DRAFT

2/18/05 SYR-85 EAB
Presidio Trust- Building 1349
Q:/Presidio-Trust/C-A-P/mxd/proposed-shallow-excavation-areas.mxd

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SUMMARY OF PROPOSED SHALLOW SOIL EXCAVATION AREAS AND DEEP SOIL AND TELECOMMUNICATION SOIL RUs

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FIGURE
5-1

Appendix A

Response to Comments Summary (In Final CAP)

Appendix B

Previous Investigation Summary (From Treadwell & Rollo SI, 2003)

Table B-1
Summary of TPH Results in Soil
Building 1349
Presidio of San Francisco, California

Boring Location	Sample Depth	Soil Screening Interval	Sample ID	Sample Date	TPH As Diesel (Carbon Range C12-C24) (mg/kg)	Unknown TPH as Diesel (Carbon Range C12-C24)[1] (mg/kg)	TPH As Fuel Oil (Carbon Range C24-C36) (mg/kg)
Soil Cleanup Levels (2)							
0 - 3 feet bgs					700	NE	980
3 - 10 feet bgs					1,380	NE	1,900
>10 feet bgs and < 5 feet above groundwater					115	NE	160
>10 feet bgs and > 5 feet above groundwater					15,000	NE	15,000
1349SB106	21	>10 feet bgs and > 5 feet above groundwater	1349SB106[21]	09/24/02	1,100	< 23	< 230
	26.5	>10 feet bgs and > 5 feet above groundwater	1349SB106[26.5]	09/24/02	680	< 24	< 240
	31.5	>10 feet bgs and < 5 feet above groundwater	1349SB106[31.5]	09/24/02	**1,100**	< 23	**< 230**
1349SB107	2.5	0 - 3	1349SB107[2.5]	09/20/02	< 11	***1,800***	**3,600**
	5.5	3 - 10	1349SB107[5.5]	09/20/02	< 57	980	1,900
	10.5	>10 feet bgs and > 5 feet above groundwater	1349SB107[10.5]	09/20/02	< 1.1	25	< 11
	15.5	>10 feet bgs and > 5 feet above groundwater	1349SB107[15.5]	09/20/02	< 1.1	1.8	< 11
	20.5	>10 feet bgs and > 5 feet above groundwater	1349SB107[20.5]	09/20/02	< 1	1.9	< 10
	25.5	>10 feet bgs and > 5 feet above groundwater	1349SB107[25.5]	09/20/02	< 1	2.1	< 10
	30.5	>10 feet bgs and > 5 feet above groundwater	1349SB107[30.5]	09/20/02	< 1.1	4.7	< 11
1349SB108	2.5	0 - 3	1349SB108[2.5]	09/20/02	< 1.1	58	86
	5.5	3 - 10	1349SB108[5.5]	09/20/02	< 1.1	5	< 11
	11	>10 feet bgs and > 5 feet above groundwater	1349SB108[11]	09/20/02	< 1.6	< 1.6	< 16
	16	>10 feet bgs and > 5 feet above groundwater	1349SB108[16]	09/20/02	< 1.6	< 1.6	< 16
	21	>10 feet bgs and > 5 feet above groundwater	1349SB108[21]	09/20/02	< 1.2	1.5	< 12
	26	>10 feet bgs and > 5 feet above groundwater	1349SB108[26]	09/20/02	< 1.3	< 1.3	< 13
	26.5	>10 feet bgs and > 5 feet above groundwater	DUP092002B	09/20/02	< 1.2	< 1.2	< 12
	31	>10 feet bgs and < 5 feet above groundwater	1349SB108[31]	09/20/02	< 1.2	< 1.2	< 12

Table B-1
Summary of TPH Results in Soil
Building 1349
Presidio of San Francisco, California

Boring Location	Sample Depth	Soil Screening Interval	Sample ID	Sample Date	TPH As Diesel (Carbon Range C12-C24) (mg/kg)	Unknown TPH as Diesel (Carbon Range C12-C24)[1] (mg/kg)	TPH As Fuel Oil (Carbon Range C24-C36) (mg/kg)
Soil Cleanup Levels (2)							
0 - 3 feet bgs					700	NE	980
3 - 10 feet bgs					1,380	NE	1,900
>10 feet bgs and < 5 feet above groundwater					115	NE	160
>10 feet bgs and > 5 feet above groundwater					15,000	NE	15,000
1349SB111	2.5	0 - 3	1349SB111[2.5]	09/20/02	< 11	***2,600***	**3,100**
	6	3 - 10	1349SB111[6]	09/20/02	< 1.1	< 1.1	< 11
	10.5	>10 feet bgs and > 5 feet above groundwater	1349SB111[10.5]	09/20/02	< 1.1	< 1.1	< 11
	16	>10 feet bgs and > 5 feet above groundwater	1349SB111[16]	09/20/02	5.8	< 1.1	< 11
	21	>10 feet bgs and > 5 feet above groundwater	1349SB111[21]	09/20/02	680	< 22	300
	26	>10 feet bgs and > 5 feet above groundwater	1349SB111[26]	09/20/02	1,800	< 44	850
	26.5	>10 feet bgs and > 5 feet above groundwater	DUP092002A	09/20/02	840	< 11	420
	31	>10 feet bgs and > 5 feet above groundwater	1349SB111[31]	09/20/02	1,300	< 45	690
1349SB112/ 1349SB113	3	0 - 3	1349SB112-COMP113[3]	09/20/02	< 1.1	25	47
1349SB114/ 1349SB115	3	0 - 3	1349SB114-COMP115[3]	09/20/02	< 1.1	3.3	< 11
1349SB116	36	>10 feet bgs and > 5 feet above groundwater	1349SB116[36]	09/23/02	82	< 1	< 10
1349SB117	3	0 - 3	1349SB117[3]	09/24/02	< 1.1	< 1.1	< 11
	5	3 - 10	1349SB117[6]	09/24/02	< 1.2	< 1.2	< 12
1349SB118	3	0 - 3	1349SB118[3]	09/24/02	< 1.1	6.9	< 11
	3.5	3 - 10	DUP092402B	09/24/02	< 1.2	1.3	< 12
	6	3 - 10	1349SB118[6]	09/24/02	< 1.2	< 1.2	< 12
1349SB119	3	0 - 3	1349SB119[3]	09/24/02	< 1.1	6	11
	6	3 - 10	1349SB119[6]	09/24/02	< 1.1	< 1.1	< 11
1349SB120	3	0 - 3	1349SB120[3]	09/24/02	1.2	< 1.2	< 12
	6	3 - 10	1349SB120[6]	09/24/02	< 1.1	31	< 11
1349SB121	2	0 - 3	1349SB121[2.0]	04/24/03	170 A-01	< 5.8	390
	5	3 - 10	1349SB121[5.0]	04/24/03	< 1.2	4.8	< 12
	7	3 - 10	1349SB121[7.0]	04/24/03	5.5 A-01	< 1.1	< 11
1349SB122	3	0 - 3	1349SB122[3.0]	04/24/03	88 A-01	< 5.6	190
	3.5	3 - 10	DUP042403A	04/24/03	990 A-01	< 11	1,900
	5	3 - 10	1349SB122[5.0]	04/24/03	890 A-01	< 6	1,600
	7	3 - 10	1349SB122[7.0]	04/24/03	**5,500 A-01**	< 12	**11,000**

Table B-1
Summary of TPH Results in Soil
Building 1349
Presidio of San Francisco, California

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Boring Location	Sample Depth	Soil Screening Interval	Sample ID	Sample Date	TPH As Diesel (Carbon Range C12-C24) (mg/kg)	Unknown TPH as Diesel (Carbon Range C12-C24)[1] (mg/kg)	TPH As Fuel Oil (Carbon Range C24-C36) (mg/kg)
Soil Cleanup Levels (2)							
0 - 3 feet bgs					700	NE	980
3 - 10 feet bgs					1,380	NE	1,900
>10 feet bgs and < 5 feet above groundwater					115	NE	160
>10 feet bgs and > 5 feet above groundwater					15,000	NE	15,000
1349SB123	2	0 - 3	1349SB123[2.0]	04/24/03	140 A-01	< 5.6	200
	5	3 - 10	1349SB123[5.0]	04/24/03	1,000 A-01	< 13	1,800
	6.5	3 - 10	1349SB123[6.5]	04/24/03	4.7 A-01	< 1.1	< 11
	7	3 - 10	DUP042403B	04/24/03	3.6 A-01	< 1.1	< 11
1349SB124	2	0 - 3	1349SB124[2.0]	04/24/03	< 1.1	14	28
	5	3 - 10	1349SB124[5.0]	04/24/03	< 1.1	1.7	< 11
	7	3 - 10	1349SB124[7.0]	04/24/03	< 1.1	3.7	< 11
1349SB125	2	0 - 3	1349SB125[2.0]	04/24/03	60	< 1.1	52
	5	3 - 10	1349SB125[5.0]	04/24/03	**11,000 A-01**	< 22	**6,200**
	6.5	3 - 10	1349SB125[6.5]	04/24/03	**5,500 A-01**	< 55	**3,600**
	7	3 - 10	DUP042403C	04/24/03	**2,100 A-01**	< 11	1,300
	10	3 - 10	1349SB125[10.0]	04/24/03	< 1.1	< 1.1	< 11
	20	>10 feet bgs and > 5 feet above groundwater	1349SB125[20.0]	04/24/03	1.4 A-01	< 1	< 10
	25	>10 feet bgs and > 5 feet above groundwater	1349SB125[25.0]	04/24/03	1.1 A-01	< 1	< 10
1349SB126	2	0 - 3	1349SB126[2.0]	04/25/03	29 A-01	< 1.1	43
	5	3 - 10	1349SB126[5.0]	04/25/03	460 A-01	< 5.5	600
	7	3 - 10	1349SB126[7.0]	04/25/03	95 A-01	< 1.4	44
	20	>10 feet bgs and > 5 feet above groundwater	1349SB126[20.0]	04/25/03	< 1.3	< 1.3	< 13
	25	>10 feet bgs and > 5 feet above groundwater	1349SB126[25.0]	04/25/03	< 1.3	< 1.3	< 13
1349SB127	2.5	0 - 3	1349SB127[2.5]	04/25/03	120 A-01	< 1.2	180
	4.5	3 - 10	1349SB127[4.5]	04/25/03	72 A-01	< 1.2	80
	5	3 - 10	DUP042503A	04/25/03	< 1.2	1.8	< 12
	7.5	3 - 10	1349SB127[7.5]	04/25/03	720 A-01	< 1.1	290
	12	>10 feet bgs and > 5 feet above groundwater	1349SB127[12.0]	04/25/03	13,000 A-01	< 14	5,900
	20	>10 feet bgs and > 5 feet above groundwater	1349SB127[20.0]	04/25/03	**17,000 A-01**	< 13	6,400
	25	>10 feet bgs and > 5 feet above groundwater	1349SB127[25.0]	04/25/03	790 A-01	< 1.1	300

Notes
1) - Total petroleum hydrocarbons were detected within the diesel range but the observed patterns did not match the standard.
2) Cleanup level values listed are obtained from Tables 1, 2 and 4 of California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Region. Order R2-2003-0080, Revised Site Cleanup Requirements (SCRs) and Recession of Order No. 91-082 and Order No. 96-070, August, 2003.
Detected concentrations in **Bold** indicate an exceedance of applicable soil screening levels.
Detected concentrations in ***Bold and Italics*** indicate the detected concentration of TPHd-unk exceeds the associated TPHd soil screening levels although TPHd soil screening levels do not apply to TPHd-unk concentrations.
TPH - Total Petroleum Hydrocarbons
"A-01" - Results are elevated due to overlap from higher boiling point hydrocarbons.
bgs - below ground surface
mg/kg - milligrams per kilogram

Table B-2
Summary of PAH Results in Soil
Building 1349
Presidio of San Francisco, California

Boring Location	Sample Depth	Soil Cleanup Interval (feet bgs)	Sample ID	Sample Date	Acenaphthene (mg/kg)	Acenaphthylene (mg/kg)	Anthracene (mg/kg)	Benzo(a)-Anthracene (mg/kg)	Benzo(a)-Pyrene (mg/kg)	Benzo(b)-Fluoranthene (mg/kg)	Benzo(g,h,i)-Perylene (mg/kg)	Benzo(k)-Fluoranthene (mg/kg)	Chrysene (mg/kg)	Dibenz(a,h)-Anthracene (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno(1,2,3-c,d)-Pyrene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
Soil Cleanup Levels [1]																				
0 - 3 feet bgs					2,700	--	5,900	0.43	0.04	0.43	620	0.43	4.3	0.078	820	770	0.27	480	600	620
3 - 10 feet bgs					2,700	--	5,900	0.43	0.04	0.43	620	0.43	4.3	0.078	820	770	0.27	480	600	620
>10 feet bgs and < 5 feet above groundwater					--	--	308	8	3	23	5,040	23	54	--	316	60	--	9	86	241
>10 feet bgs and > 5 feet above groundwater					--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1349SB107	2.5	0 - 3	1349SB107[2.5]	09/20/02	< 0.37	< 0.37	< 0.37	< 0.37	**0.260 J**	< 0.37	0.240 J	< 0.37	< 0.37	**0.230 J**	0.210 J	< 0.37	0.220 J,J+	< 0.37	< 0.37	< 0.37
	5.5	3 - 10	1349SB107[5.5]	09/20/02	< 0.038	< 0.038	0.019 J	< 0.038	0.032 J	0.028 J	0.034 J	< 0.038	< 0.038	0.026 J	0.024 J	< 0.038	0.026 J	< 0.038	< 0.038	0.023 J
	10.5	> 10	1349SB107[10.5]	09/20/02	< 0.0036	< 0.0036	< 0.0036	< 0.0036	0.0023 J	0.0023 J	0.003 J	< 0.0036	< 0.0036	0.0022 J	0.0024 J	< 0.0036	0.0024 J	< 0.0036	< 0.0036	0.0021 J
	15.5	> 10	1349SB107[15.5]	09/20/02	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038
	20.5	> 10	1349SB107[20.5]	09/20/02	< 0.0041	< 0.0041	< 0.0041	< 0.0041	0.0021 J	0.0035 J	0.0025 J	< 0.0041	< 0.0041	0.0026 J	0.0027 J	< 0.0041	0.0023 J	< 0.0041	0.0034 J	< 0.0041
	25.5	> 10	1349SB107[25.5]	09/20/02	< 0.0035	< 0.0035	< 0.0035	< 0.0035	< 0.0035	0.002 J	0.0019 J	< 0.0035	< 0.0035	0.0021 J	0.0019 J	< 0.0035	0.0019 J	0.0033 J	0.0019 J	< 0.0035
	30.5	> 10	1349SB107[30.5]	09/20/02	< 0.0035	0.0039	0.084	0.0021 J	0.0021 J	0.0097	0.0067	< 0.0035	0.017	0.0039	0.0098	0.0037	0.0029 J	0.0023 J	0.082	0.011
1349SB108	2.5	0 - 3	1349SB108[2.5]	09/20/02	< 0.0036	0.0019 J	0.0021 J	0.0054 J+	0.0043 J+	0.0063 J+	0.0042 J+	0.002 J,J+	0.0048 J+	0.0027 J,J+	0.0063	< 0.0036	0.0044 J+	< 0.0036	0.0026 J	0.0075 J+
	5.5	3 - 10	1349SB108[5.5]	09/20/02	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037
	11	> 10	1349SB108[11]	09/20/02	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053	< 0.0053
	16	> 10	1349SB108[16]	09/20/02	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052
	21	> 10	1349SB108[21]	09/20/02	< 0.004	< 0.004	< 0.004	< 0.004	0.002 J	< 0.004	0.0021 J	< 0.004	< 0.004	< 0.004	0.0021 J	< 0.004	0.0022 J	< 0.004	< 0.004	< 0.004
	26	> 10	1349SB108[26]	09/20/02	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052	< 0.0052
	26.5	> 10	DUP092002B	09/20/02	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
	31	> 10	1349SB108[31]	09/20/02	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004	< 0.004
1349SB111	2.5	0 - 3	1349SB111[2.5]	09/20/02	<0.36	<0.36	0.18 J	<0.36	**0.2 J, J+**	< 0.360	0.230 J,J+	< 0.360	< 0.360	**0.220 J,J+**	0.190 J	< 0.360	0.210 J	< 0.360	< 0.360	0.290 J
	6	3 - 10	1349SB111[6]	09/20/02	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037
	10.5	> 10	1349SB111[10.5]	09/20/02	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036	< 0.0036
	16	> 10	1349SB111[16]	09/20/02	< 0.0035	0.0019 J	0.002 J	< 0.0035	0.0019 J	< 0.0035	0.0019 J	< 0.0035	< 0.0035	0.0021 J	0.0021 J	0.0032 J	0.002 J	< 0.0035	0.0065	0.002 J
	21	> 10	1349SB111[21]	09/20/02	0.64	0.3	0.2	0.13	0.078	0.064 J	0.045 J	0.040 J	0.18	0.047 J	0.1	0.78	0.043 J	2	1.4	0.22
	26	> 10	1349SB111[26]	09/20/02	0.98	0.44	0.360 J-	0.31	0.140 J	0.100 J	0.100 J	< 0.150 UJ	0.250 Q-28a,J-	0.097 J	0.18	1.2	0.082 J	0.130 J	2.3	0.440 Q-28,J-
	26.5	> 10	DUP092002A	09/20/02	0.19	0.077	0.09	0.057	0.036 J	0.026 J	0.027 J	< 0.038	0.097	0.025 J	0.047	0.19	0.024 J	< 0.038	0.54	0.12
	31	> 10	1349SB111[31]	09/20/02	0.41	0.18	0.017	0.11	0.070 J	0.053 J	0.047 J	< 0.074	0.18	0.047 J	0.099	0.47	0.041 J	0.088	1.1	0.21
1349SB112/ 1349SB113	3	0 - 3	1349SB112-COMP113[3]	09/20/02	0.14	0.15	0.13	0.18	**0.13**	0.15	0.15	0.14	0.17	**0.16**	0.13	0.16	0.19	0.13	0.15	0.17
1349SB114/ 1349SB115	3	0 - 3	1349SB114-COMP115[3]	09/20/02	< 0.0037	< 0.0037	< 0.0037	< 0.0037	0.0019 J	< 0.0037	0.0021 J	< 0.0037	< 0.0037	0.0022 J	<0.36	< 0.0037	0.0022 J	< 0.0037	< 0.0037	< 0.0037
1349SB116	36	> 10	1349SB116[36]	09/23/02	0.022	0.0072	0.013 J+	0.0055 J+	0.0025 J,J+	0.005 J+	0.006 J+	< 0.0034	0.012 J+	0.0032 J,J+	0.009 J+	0.036	0.0026 J,J+	0.0039 J-	0.047 J+	0.047 J+
1349SB117	3	0 - 3	1349SB117[3]	09/24/02	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	0.002 J	< 0.0038	< 0.0038	0.0022 J	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038
	5	3 - 10	1349SB117[6]	09/24/02	< 0.0038	< 0.0038	< 0.0038	< 0.0038	0.0019 J	< 0.0038	0.002 J	< 0.0038	< 0.0038	0.0022 J	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038	< 0.0038
1349SB118	3	0 - 3	1349SB118[3]	09/24/02	< 0.0072	< 0.0072	< 0.0072 Q-28a,UJ	< 0.0072	< 0.0072	< 0.0072	< 0.0072	< 0.0072 UJ	< 0.0072 Q-28b,UJ	< 0.0072	< 0.0072	< 0.0072	< 0.0072	< 0.0072	< 0.0072	< 0.0072 Q-28,UJ
	3.5	3 - 10	DUP092402B	09/24/02	< 0.0078	< 0.0078	< 0.0078 Q-28a,UJ	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078 UJ	< 0.0078 Q-28b,UJ	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078 Q-28,UJ
	6	3 - 10	1349SB118[6]	09/24/02	< 0.0076	< 0.0076	< 0.0076 Q-28a,UJ	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076 UJ	< 0.0076 Q-28b,UJ	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076 Q-28,UJ
1349SB119	3	0 - 3	1349SB119[3]	09/24/02	< 0.0037	< 0.0037	< 0.0037	< 0.0037	0.002 J	< 0.0037	0.0024 J	< 0.0037	< 0.0037	0.0022 J	0.0021 J	< 0.0037	0.0022 J	< 0.0037	< 0.0037	< 0.0037 U
	6	3 - 10	1349SB119[6]	09/24/02	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037	< 0.0037 U
1349SB120	3	0 - 3	1349SB120[3]	09/24/02	< 0.0079	< 0.0079	< 0.0079 Q-28a,UJ	< 0.0079	< 0.0079	< 0.0079	0.0041 J	< 0.0079 UJ	< 0.0079 Q-28b,UJ	0.0046 J	< 0.0079	< 0.0079	0.0042 J	< 0.0079	< 0.0079	< 0.0079 Q-28,UJ
	6	3 - 10	1349SB120[6]	09/24/02	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]	NA [1]
1349SB121	2	0 - 3	1349SB121[2.0]	04/24/03	0.010 J	0.023	0.059	0.12	**0.1**	0.11	0.053	0.036	0.15	0.014 J	0.18	0.028	0.034	0.0077 J	0.24	0.38
	5	3 - 10	1349SB121[5.0]	04/24/03	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076
	7	3 - 10	1349SB121[7.0]	04/24/03	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075
1349SB122	3	0 - 3	1349SB122[3.0]	04/24/03	< 0.015	< 0.015	0.051 J	0.026	0.033	0.051	0.06	0.012 J	0.032	0.0096 J	0.048	< 0.015	0.022 J	0.0062 J	0.031	0.094
	3.5	3 - 10	DUP042403A	04/24/03	< 0.015	< 0.015	0.055 J	0.03	**0.045**	0.063	0.057	0.015 J	0.042	0.011 J	0.046	< 0.015	0.023 J	0.0054 J	0.034	0.098
	5	3 - 10	1349SB122[5.0]	04/24/03	0.0053 J	0.0063 J	0.024	0.042	**0.084**	0.11	0.1	0.012 J	0.24	0.025 J	0.046	0.042	0.047	0.0069 J	0.052	0.2
	7	3 - 10	1349SB122[7.0]	04/24/03	< 0.081	< 0.081	< 0.081	< 0.081	**< 0.160**	0.120 J	0.088 J	< 0.160	0.4	0.044 J	< 0.081	0.14	< 0.160	< 0.081	0.11	0.098

Table B-2
Summary of PAH Results in Soil
Building 1349
Presidio of San Francisco, California

Boring Location	Sample Depth	Soil Cleanup Interval (feet bgs)	Sample ID	Sample Date	Acenaphthene (mg/kg)	Acenaphthylene (mg/kg)	Anthracene (mg/kg)	Benzo(a)-Anthracene (mg/kg)	Benzo(a)-Pyrene (mg/kg)	Benzo(b)-Fluoranthene (mg/kg)	Benzo(g,h,i)-Perylene (mg/kg)	Benzo(k)-Fluoranthene (mg/kg)	Chrysene (mg/kg)	Dibenz(a,h)-Anthracene (mg/kg)	Fluor-anthene (mg/kg)	Fluorene (mg/kg)	Indeno(1,2,3-c,d)-Pyrene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
Soil Cleanup Levels [1]																				
0 - 3 feet bgs					2,700	--	5,900	0.43	0.04	0.43	620	0.43	4.3	0.078	820	770	0.27	480	600	620
3 - 10 feet bgs					2,700	--	5,900	0.43	0.04	0.43	620	0.43	4.3	0.078	820	770	0.27	480	600	620
>10 feet bgs and < 5 feet above groundwater					--	--	308	8	3	23	5,040	23	54	--	316	60	--	9	86	241
>10 feet bgs and > 5 feet above groundwater					--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1349SB123	2	0 - 3	1349SB123[2.0]	04/24/03	< 0.015	< 0.015	0.065 J	0.029	**0.048**	0.073	0.043	0.015 J	0.031	0.0099 J	0.029	< 0.015	0.024 J	< 0.015	0.03	0.11
	5	3 - 10	1349SB123[5.0]	04/24/03	< 0.034	< 0.034	< 0.034	< 0.085	**0.046 J**	0.1	0.087	< 0.085	0.23	0.025 J	0.014 J	< 0.034	0.042 J	< 0.034	0.028 J	0.039 J
	6.5	3 - 10	1349SB123[6.5]	04/24/03	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076
	7	3 - 10	DUP042403B	04/24/03	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074
1349SB124	2	0 - 3	1349SB124[2.0]	04/24/03	< 0.0073	< 0.0073	< 0.0073	0.0014 J	< 0.0073	< 0.0073	< 0.0073	< 0.0073	< 0.0073	< 0.0073	< 0.0073	< 0.0073	< 0.0073	< 0.0073	< 0.0073	< 0.0073
	5	3 - 10	1349SB124[5.0]	04/24/03	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074	< 0.0074
	7	3 - 10	1349SB124[7.0]	04/24/03	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075 UJ	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075	< 0.0075
1349SB125	2	0 - 3	1349SB125[2.0]	04/24/03	< 0.0071	< 0.0071	0.0017 J	0.012	0.017	0.031	0.021	0.087	0.0016	0.0035 J	0.01	< 0.0071	0.011	< 0.0071	0.0086	0.025
	5	3 - 10	1349SB125[5.0]	04/24/03	0.0061 J	0.0055 J	0.053 J	0.049	0.037	0.12	0.022 J	< 0.029	0.16	0.015 J	0.051	0.0052 J	0.010 J	< 0.015	0.064	0.32
	6.5	3 - 10	1349SB125[6.5]	04/24/03	0.2	0.017	< 0.014	0.064	0.021 J	0.084	0.013 J	< 0.029	0.21	0.0098 J	0.19	0.54	0.0057 J	0.17	2.4	0.25
	7	3 - 10	DUP042403C	04/24/03	0.068	0.035	0.011 J	0.041	< 0.028	0.051	0.0076 J	< 0.028	0.15	0.0057 J	0.065	0.045	< 0.028	0.048	1.6	0.17
	10	3 - 10	1349SB125[10.0]	04/24/03	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007 UJ	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
	20	> 10	1349SB125[20.0]	04/24/03	< 0.0068	< 0.0068	< 0.0068	< 0.0068	< 0.0068	< 0.0068	< 0.0068 UJ	< 0.0068	< 0.0068	< 0.0068	< 0.0068	< 0.0068	< 0.0068	< 0.0068	< 0.0068	< 0.0068
	25	> 10	1349SB125[25.0]	04/24/03	< 0.0069	< 0.0069	< 0.0069	< 0.0069	< 0.0069	< 0.0069	< 0.0069 UJ	< 0.0069	0.0018 J	< 0.0069	< 0.0069	< 0.0069	< 0.0069	< 0.0069	0.0063 J	< 0.0069
1349SB126	2	0 - 3	1349SB126[2.0]	04/25/03	< 0.030	< 0.030	0.0061 J	0.024 J	0.016 J	0.033	0.018 J	0.011 J	0.046	< 0.030	0.032	<0.0 30	0.011 J	<0.030	0.043	0.043
	5	3 - 10	1349SB126[5.0]	04/25/03	< 0.054	< 0.054	< 0.054	0.028 J	**0.084**	0.085	0.062	< 0.054	0.063	0.016 J	0.010 J	< 0.054	0.25 J	< 0.054	0.035 J	0.14
	7	3 - 10	1349SB126[7.0]	04/25/03	0.0034 J	< 0.0095	0.004 J	0.0028 J	< 0.0095	< 0.0095	< 0.0095	< 0.0095	0.004 J	< 0.0095	< 0.0095	< 0.0095	< 0.0095	< 0.0095	0.023	0.0043 J
	20	> 10	1349SB126[20.0]	04/25/03	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0086	< 0.0086	0.0038 J	< 0.0086	< 0.0086
	25	> 10	1349SB126[25.0]	04/25/03	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085	< 0.0085
1349SB127	2.5	0 - 3	1349SB127[2.5]	04/25/03	< 0.031	< 0.031	< 0.031	0.021 J	0.033	0.045	0.041	0.012 J	0.021 J	0.0069 J	0.028 J	< 0.031	0.019 J	< 0.031	0.023 J	0.041
	4.5	3 - 10	1349SB127[4.5]	04/25/03	< 0.032	< 0.032	< 0.032	< 0.032	< 0.032	< 0.032	< 0.032	< 0.032	**19 J**	< 0.032	< 0.032	< 0.032	< 0.032	< 0.032	< 0.032	0.039
	5	3 - 10	DUP042503A	04/25/03	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.0082
	7.5	3 - 10	1349SB127[7.5]	04/25/03	0.017	0.061	0.082	0.049	0.015 J	0.019 J	0.0067 J	< 0.029	0.085	< 0.029	0.026 J	0.35	< 0.029	0.63	0.56	0.087
	12	> 10	1349SB127[12.0]	04/25/03	2.1	0.83	1.2	0.73	0.27	0.28	0.081 J	< 0.095	1.3	0.035 J	0.37	4.8	0.040 J	11	7.5	1.5
	20	> 10	1349SB127[20.0]	04/25/03	4.2	1.8	2	1.3	0.42	0.45	0.120 J	< 0.130	2.1	0.063 J	0.63	1.3	0.068 J	17	12	2.4
	25	> 10	1349SB127[25.0]	04/25/03	0.1	0.033	0.058	0.044	< 0.030	0.015 J	< 0.030	< 0.030	0.072	< 0.030	0.018 J	0.075	< 0.030	0.14	0.39	0.84
1349SB128	3	0 - 3	1349SB128[3.0]	04/24/03	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078	< 0.0078
	6	3 - 10	1349SB128[6.0]	04/24/03	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	0.0021 J	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076
1349SB129	3	0 - 3	1349SB129[3.0]	04/24/03	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.0079
	6	3 - 10	1349SB129[6.0]	04/24/03	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076	< 0.0076
1349SB130	3	0 - 3	1349SB130[3.0]	04/24/03	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	0.0089 J	< 0.0077 J	< 0.015	< 0.015	0.0029 J	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015
	6	3 - 10	1349SB130[6.0]	04/24/03	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.015	< 0.015	< 0.015	< 0.015	< 0.0077	< 0.015	< 0.0077	< 0.0077	< 0.015	< 0.0077	< 0.0077	< 0.0077
1349SB131	2.5	0 - 3	1349SB131[2.5]	04/24/03	< 0.0082	< 0.0082	< 0.0082	< 0.0082	< 0.016	< 0.016	0.0032 J	< 0.016	< 0.0082	< 0.016	0.0037 J	0.0076 J	< 0.016	< 0.0082	0.0022 J	0.0042 J
	6	3 - 10	1349SB131[6.0]	04/24/03	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077
1349SB132	2.5	0 - 3	1349SB132[2.5]	04/24/03	< 0.0079	< 0.0079	< 0.0079	< 0.0079	< 0.016	< 0.016	< 0.016	< 0.016	< 0.0079	< 0.016	< 0.0079	< 0.0079	< 0.016	< 0.0079	< 0.0079	< 0.0079
	5	3 - 10	1349SB132[5.0]	04/24/03	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077
1349SB133	2.5	0 - 3	1349SB133[2.5]	04/24/03	< 0.017	< 0.017	< 0.017	0.015 J	0.016 J	0.027	0.010 J	0.0076 J	0.02	0.0033 J	0.023	< 0.017	0.0062 J	< 0.017	0.010 J	0.029
	5	3 - 10	1349SB133[5.0]	04/24/03	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077	< 0.0077

Notes

1) Cleanup level values listed are obtained from Tables 1, 2 and 4 of California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Region.
Order R2-2003-0080, Revised Site Cleanup Requirements (SCRs) and Recession of Order No. 91-082 and Order No. 96-070, August, 2003.

Bold indicates value above cleanup level

J+ - The analyte was positively identified; the associated numerical value is biased high due to a high surrogate recovery and should be considered an approximate concentration of the analyte in the sample.

J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Q-28 - The opening calibration verification standard was outside acceptance criteria by 1.2%. Although the Laboratory Control Sample verified the accuracy of the batch, this should be considered in evaluating the data for its intended purpose.

Q-28a - The opening calibration verification standard was outside acceptance criteria by 1.7%. Although the Laboratory Control Sample verified the accuracy of the batch, this should be considered in evaluating the data for its intended purpose.

Q-28b - The opening calibration verification standard was outside acceptance criteria by 8.7%. Although the Laboratory Control Sample verified the accuracy of the batch, this should be considered in evaluating the data for its intended purpose.

PAH - Polycyclic Aromatic Hydrocarbon

μg/kg - micrograms per kilogram

-- - Not applicable

1 - Sample was not analyzed due to extraction errors and insufficient sample volume.

Table B-3
Summary of TPH and BTEX Results at Telecommunications Conduit
Building 1349
Presidio of San Francisco, California

Sample ID	Sample Depth	Soil Cleanup Interval	Sample Date	TPH As Diesel (Carbon Range C12-C24)	Unknown TPH as Diesel (Carbon Range C12-C24)1	TPH As Fuel Oil (Carbon Range C24-C36)	Benzene	Toluene	Ethylbenzene	Xylenes (Total)
				(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Soil Cleanup Levels (1)										
0 - 3 feet bgs				700	NE	980	0.6	270	125	55
3 - 10 feet bgs				1,380	NE	1,900	0.6	530	840	1,080
>10 feet bgs and <5 feet above groundwater				115	NE	160	0.005	0.005	0.009	0.009
> 10 feet bgs and > 5 feet above groundwater				15,000		15,000	140	420	60	180
CSC1	3	0-3	11/17/95	**14,000**	--	--	< 0.12 UJ	0.17 J	0.53 J	4.3 J
CSC6	3	0-3	11/17/95	**24,000**	--	--	< 0.19 U	< 0.19 U	2.4	12 J
CSC8	3	0-3	11/17/95	**18,000**	--	--	< 0.052 U	< 0.052 U	0.64	4.4 J
CSC4	4	3-10	11/17/95	**14,000**	--	--	< 0.12 UJ	< 0.12 UJ	0.47 J	1.3 J
CSC3	6	3-10	11/17/95	**13,000**	--	--	< 0.12 UJ	< 0.12 UJ	0.21 J	0.91 J
CSC2	12	> 10	11/17/95	3,200	--	--	< 0.0058 UJ	0.0067 J	0.034 J	0.22 J
CSC5	12	> 10	11/17/95	6,300	--	--	< 0.11 U	0.32	1.8	11 J
CSC7	12	> 10	11/17/95	10,000	--	--	< 0.061 U	0.099	0.97	3.1 J
CSC9	12	> 10	11/17/95	5,900	--	--	< 0.21 U	0.99	1.2	9 J

Notes
1) Cleanup level values listed are obtained from Tables 1, 2 and 4 of California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Region. Order R2-2003-0080, Revised Site Cleanup Requirements (SCRs) and Recession of Order No. 91-082 and Order No. 96-070, August, 2003.
Detected concentrations in **Bold** indicate an exceedance of applicable soil cleanup levels.
TPH - Total Petroleum Hydrocarbons
bgs - below ground surface
mg/kg - milligrams per kilogram
-- - Not analyzed
J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

Table B-4
Summary of PAH Results at Telecommunications Conduit
Building 1349
Presidio of San Francisco, California

Sample ID	**Sample Depth**	**Soil Screening Interval** (feet bgs)	**Sample Date**	**Anthracene** (mg/kg)	**Benzo(a)-Anthracene** (mg/kg)	**Benzo(a)-Pyrene** (mg/kg)	**Benzo(b)-Fluoranthene** (mg/kg)	**Benzo(g,h,i)-Perylene** (mg/kg)	**Benzo(k)-Fluoranthene** (mg/kg)	**Chrysene** (mg/kg)	**Fluor-anthene** (mg/kg)	**Fluorene** (mg/kg)	**Naphthalene** (mg/kg)	**Phenanthrene** (mg/kg)	**Pyrene** (mg/kg)
Soil Cleanup Levels (1)															
0 - 3 feet bgs				5,900	0.43	0.04	0.43	620	0.43	4.3	820	770	480	600	620
3 - 10 feet bgs				5,900	0.43	0.04	0.43	620	0.43	4.3	820	770	480	600	620
>10 feet bgs and < 5 feet above groundwater				308	8	3	23	5,040	23	54	316	60	9	86	241
> 10 feet bgs and > 5 feet above groundwater				--	--	--	--	--	--	--	--	--	--	--	--
CSC1	3	0-3	11/17/95	< 1.10 U	**< 2.3 U**	**2**	**< 2.3 U**	< 2.3 U	**< 2.3 U**	< 1.1 U	< 1.1 U	4	24	<1.1 J	< 1.1 U
CSC6	3	0-3	11/17/95	< 12 UJ	**< 23 UJ**	**< 4 UJ**	**< 23 UJ**	< 23 UJ	**< 2.3 UJ**	**< 12 UJ**	< 1.2 UJ	< 12 UJ	51 J	15 J	< 12 UJ
CSC8	3	0-3	11/17/95	< 5.6 UJ	**< 11 UJ**	**< 2 UJ**	**< 11 UJ**	< 11 UJ	**< 11 UJ**	**< 5.6 UJ**	< 5.6 UJ	< 5.6 UJ	< 5.6 UJ	6.8 J	< 5.6 UJ
CSC3	6	3-10	11/17/95	< 2.4 U	**< 4.9 U**	**<0.86 U**	**< 4.90 U**	< 4.9 U	**< 4.9 U**	< 2.4 U	< 2.4 U	< 2.4 U	4	< 2.4 U	< 2.4 U
CSC4	4	3-10	11/17/95	< 2.2 U	**< 4.4 U**	**< 0.77 U**	**< 4.4 U**	< 4.4	**< 4.9 U**	< 2.2 U	< 2.2 U	< 2.2 U	16	< 2.2 U	< 2.2 U
CSC2	12	> 10	11/17/95	< 1.1 U	< 2.3 U	< 0.4 U	< 2.3 U	< 2.3 U	< 2.3 U	< 1.1 U	< 1.1 U	1	4	2	< 1.1 U
CSC5	12	> 10	11/17/95	< 0.11 U	< 0.22 U	89	< 0.22 U	< 0.22 U	< 0.22 U	0.15	<0.11 U	1.2 J	16	1.2 J	4
CSC7	12	> 10	11/17/95	< 0.12 U	< 0.25 U	< 0.44 U	<0.25 U	<0.25 U	<0.25 U	<0.12 U	<0.12 U	1.5	4	2.4 J	0.48
CSC9	12	> 10	11/17/95	< 1.2 UJ	< 2.4 UJ	< 420 UJ	< 2.4 UJ	< 2.4 UJ	< 2.4 UJ	< 1.2 UJ	< 1.2 UJ	1.4 J	17 J	1.8 J	<1.2 UJ

Notes

1) Cleanup level values listed are obtained from Tables 1, 2 and 4 of California Environmental Protection Agency, Regional Water Quality Control Board, San Francisco Bay Region.
Order R2-2003-0080, Revised Site Cleanup Requirements (SCRs) and Recession of Order No. 91-082 and Order No. 96-070, August, 2003.

J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

U - The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

UJ - The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

PAH - Polycyclic Aromatic Hydrocarbon

µg/kg - micrograms per kilogram

-- - Not applicable

Table B-5
Results of General Chemistry Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	pH	Alkalinity Total	Bicarbonate	Chloride	Dissolved Oxygen	Fluoride	N as Nitrate	N as Nitrite	N as Nitrate + Nitrite	Sulfate
	Analytical Method[1]	Field	E310.1	E310.1	E300.0/ SW9056	Field	E300.0/ E340.2/ SW9056	E300.0/ E353.2/ SW9056	E300.0/ E353.2/ SW9056	E353.2	E300.0/ SW9056
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
1349MW01	03/15/04	5.60	280	280	740	0.39	0.11	2.2	< 0.1	NA	250
	12/02/03	6.70	310	310	690	1.1	0.14	2.2	< 0.05	NA	220
	08/21/03	6.25	310	310	700	1.42	< 0.2	1.8	< 0.1	NA	220
	06/10/03	6.34	380	380	740	1.29	< 0.2	2.1	< 0.1	NA	230
	03/12/03	6.28	NA	NA	NA	1.59	NA	NA	NA	NA	NA
	12/09/02		360	360	750	0.76	< 0.2	1.7	< 0.1	NA	210
DUP1209021A	12/09/02		350	350	750	--	< 0.2	1.8	< 0.1	NA	220
1349MW01CL	12/09/02		350	350	360	--	1	1.4 J-	< 0.05 UJ	1.4 J-	220
	08/28/02		270	270	740	1.34	0.13	1.7	< 0.05	NA	240
	05/30/02		320	320	810	1.37	0.091 J	1.7	< 0.05	NA	230
	03/06/02		290	290	830	2.13	0.13	1.8	< 0.05	NA	250
	11/28/01		310	310	820	1.36	0.13	1.8	< 0.05	NA	240
	08/30/01		420	420	740	0.61	0.24	1.3	< 2.5	NA	180
DUP0830013A	08/30/01		430	430	740	--	0.14	1.2	< 2.5	NA	180
1349MW01CL	08/30/01		340	340	760	--	< 0.05	1.4 [2]	< 2.5	NA	210
	05/10/01		330	330	760	1.45	0.19	1.4	< 0.05	NA	220
	05/19/99		433	433	820	0.83	0.2	NA	NA	0.537	188
	02/19/99		468	468	731	1.83	0.15	NA	NA	0.641	192
	11/18/98		361	361	666	1.59	0.17	NA	NA	0.62	205
	08/18/98		574	574	701	2.24	0.11	NA	NA	0.404	161
	04/16/98		377	377	679	2.89	0.12	NA	NA	0.715	221
	01/22/98		509	509	673	1	0.124	NA	NA	0.416	159
	10/30/97		527	527	726	0.37	< 0.05	0.478	NA	0.368	158
	07/31/97		466	466	777	0.5	NA	0.532	NA	0.617	192
	05/01/97		489	489	768	1.17	NA	0.451	NA	NA	190
	02/10/97		374	374	888	1.26	NA	0.635	NA	< 0.05	262
	08/08/95		NA	NA	NA	NM	NA	NA	NA	NA	NA
1349MW02	05/26/04	7.09	660	660	650	0.59	0.11	1.3	< 0.1	NA	64
	03/15/04	7.11	630	630	670	0.44	< 0.1	1.4	< 0.1	NA	66
	12/02/03	7.00	720	720	600	0.6	< 0.1	1.6	< 0.05	NA	64
	08/13/03	6.11	710	710	550	1.6	< 1	1.3 b,J-	< 0.5 UJ	NA	73

Table B-5
Results of General Chemistry Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	pH	Alkalinity Total	Bicarbonate	Chloride	Dissolved Oxygen	Fluoride	N as Nitrate	N as Nitrite	N as Nitrate + Nitrite	Sulfate
	Analytical Method[1]	Field	E310.1	E310.1	E300.0/ SW9056	Field	E300.0/ E340.2/ SW9056	E300.0/ E353.2/ SW9056	E300.0/ E353.2/ SW9056	E353.2	E300.0/ SW9056
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
1349MW02	06/05/03	7.52	630	630	610	1.3	< 0.2	1.6	< 0.1	NA	62
DUP0605032A	06/05/03		620	620	610	NA	< 0.2	1.6	< 0.1	NA	62
	03/12/03	7.32	NA	NA	NA	0.3	NA	NA	NA	NA	NA
	12/04/02		660	660	580	1.8	< 0.2	1.7	< 0.1	NA	62
DUP1204023A	12/04/02		670	670	560	--	< 0.2	1.7	< 0.1	NA	63
	08/28/02		670	670	570	1	0.12	1.6	< 0.05	NA	68
1349MW02	05/30/02		680	680	630	0.7	0.12	1.6	< 0.05	NA	60
	03/06/02		640	640	680	1.2	0.13	1.6	< 0.05	NA	58
DUP0306022A	03/06/02		640	640	670	--	0.13	1.6	< 0.05	NA	59
	11/28/01		670	670	580	2.25	0.091 J	1.7	< 0.05	NA	60
DUP1128011A	11/28/01		680	680	570	--	0.1 J	1.8	< 0.05	NA	56
	08/30/01		660	660	570	NM	0.11	1.7	< 0.05	NA	64
DUP0830012A	08/30/01		660	660	550	--	0.11	1.7	< 0.05	NA	63
1349MW02CL	08/30/01		660	660	550	--	< 0.1	1.5 [2]	< 0.05	NA	56
	05/10/01		660	660	570	1.3	0.12	1.7	< 0.05	NA	62
	05/19/99		680	680	724	0.51	< 0.1	NA	NA	1.58	76
	02/19/99		706	706	766	0.6	< 0.1	NA	NA	1.29	80
	11/18/98		694	694	690	0.71	< 0.1	NA	NA	1.22	69
	08/18/98		688	688	637	0.39	< 0.1	NA	NA	1.24	69
	04/16/98		629	629	555	0.9	< 0.1	NA	NA	1.23	64
	01/22/98		689	689	586	1.34	< 0.1	NA	NA	1.12	60
	10/30/97		700	700	653	0.33	< 0.05	1.3	NA	1.21	72
	07/31/97		679	679	662	0.62	NA	1.29	NA	1.2	73
	05/01/97		696	696	661	0.31	NA	1.18	NA	NA	61
	02/10/97		548	548	501	0.5	NA	0.924	NA	1.3	52
	08/08/95		NA	NA	NA	NM	NA	NA	NA	NA	NA
1349MW03	03/12/03		NA	NA	NA	NM	NA	NA	NA	NA	NA
	08/28/02		440	440	110	1.4	< 0.1	5.9	< 0.05	NA	42
DUP0828022A	08/28/02		450	450	100	--	< 0.1	5.8	< 0.05	NA	42
1349MW03CL	08/28/02		420	420	110	--	< 1	6.1 [2]	< 1	NA	43

Table B-5
Results of General Chemistry Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	pH	Alkalinity Total	Bicarbonate	Chloride	Dissolved Oxygen	Fluoride	N as Nitrate	N as Nitrite	N as Nitrate + Nitrite	Sulfate
	Analytical Method[1]	Field	E310.1	E310.1	E300.0/ SW9056	Field	E300.0/ E340.2/ SW9056	E300.0/ E353.2/ SW9056	E300.0/ E353.2/ SW9056	E353.2	E300.0/ SW9056
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
1349MW03	05/30/02		460	460	100	1.2	0.22	7	< 0.05	NA	41
DUP0530021A	05/30/02		470	470	110	--	0.22	7.4	< 0.05	NA	42
1349MW03CL	05/30/02		460	460	100	--	< 1	5.6 [2]	< 1	NA	44
	03/06/02		470	470	110	1.1	0.18	5.6	< 0.05	NA	47
DUP0306022B	03/06/02		470	470	110	--	0.16	5.6	< 0.05	NA	47
1349MW03CL	03/06/02		460	460	110	--	< 1	5.9 [2]	< 1	NA	49
	11/28/01		490	490	140	1.8	0.073 J	6.4	< 0.05	NA	46
DUP1128011B	11/28/01		480	480	140	--	0.13	6.6	< 0.05	NA	47
1349MW03CL	11/28/01		470	470	330	--	< 1	6.8 [2]	< 1	NA	73
	08/30/01		500	500	140	0.5	0.18	6.4	< 0.05	NA	49
	05/10/01		490	490	120	1.2	0.11	5.2	< 0.05	NA	49
	05/19/99		501	501	152	1.32	< 0.1	NA	NA	4.75	54
	02/19/99		472	472	106	1.61	< 0.1	NA	NA	5.19	47
	11/18/98		479	479	142	1.45	< 0.1	NA	NA	5.74	45
	08/18/98		482	482	138	1.56	< 0.1	NA	NA	5.32	45
	04/16/98		461	461	110	1.63	< 0.1	NA	NA	5	45
	01/22/98		424	424	53.3	2.35	0.104	NA	NA	5.34	46
	10/30/97		460	460	174	1.03	< 0.05	5.64	NA	5.27	50
	07/31/97		451	451	145	1.14	NA	5.52	NA	5.33	46
	05/01/97		500	500	162	1.28	NA	4.58	NA	NA	48
	02/10/97		427	427	63	1.79	NA	5.84	NA	6.26	35
	08/08/95		NA	NA	NA	NM	NA	NA	NA	NA	NA
1349MW03R	05/26/04	7.64	340	340	79	5.7	< 0.1	4.5	< 0.05	NA	31
	03/09/04	7.68	380	380	78	7.08	< 0.1	4.5	< 0.05	NA	33
	12/02/03	7.90	350	350	72	5.2	< 0.1	4.8	< 0.05	NA	22
	08/13/03	8.00	360	360	78	4.8	< 0.5	4.5 b,J-	< 0.25 UJ	NA	32
	06/09/03	8.10	330	330	130	2.6	0.37	4.7	0.1	NA	33
1349MW100	05/27/04	6.30	940	940	1100	0.55	0.28	< 0.05	< 0.1	NA	2
	03/16/04	6.77	900	900	830	0.37	0.24	< 0.05	< 0.1	NA	10
1349MW100	12/02/03	6.70	890	890	1,200	1	0.24	< 0.1	< 0.1	NA	< 1
	08/12/03	6.19	800	800	1,100	0.5	< 0.5	< 0.25	< 0.25	NA	< 2.5
	06/09/03	6.84	860	860	890	1.8	< 0.5	< 0.25	< 0.25	NA	3.5
	03/12/03	6.50	810	810	840	0.6	< 0.2	< 0.1	< 0.1	NA	7.7
	12/10/02		660	660	1,300	0.9	< 0.2	< 0.1	< 0.1	NA	9.2
1349MW101	03/09/04	7.80	260	260	210	3.52	0.13	3.5	< 0.05	NA	19
	12/02/03	7.90	390	390	230	1.4	0.14	2.4	< 0.05	NA	19
	08/19/03	8.00	280	280	260	1.7	0.25	2.5	< 0.05	NA	25
	06/09/03	7.77	230	230	300	1.1	0.47	4.3	0.13	NA	38

Table B-5
Results of General Chemistry Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	pH	Alkalinity Total	Bicarbonate	Chloride	Dissolved Oxygen	Fluoride	N as Nitrate	N as Nitrite	N as Nitrate + Nitrite	Sulfate
	Analytical Method[1]	Field	E310.1	E310.1	E300.0/ SW9056	Field	E300.0/ E340.2/ SW9056	E300.0/ E353.2/ SW9056	E300.0/ E353.2/ SW9056	E353.2	E300.0/ SW9056
			(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
1349MW102	05/27/04	6.70	600	600	410	1.1	0.27	0.52	< 0.05	NA	44
DUP0527041A	05/27/04	6.70	630	630	400	NA	0.26	0.74	< 0.05	NA	47
1349MW102CL	05/27/04	6.70	620	620	88	NA	0.29	0.6	< 0.05	0.6	18
	03/10/04	6.72	540	540	470	0.5	0.27	0.4	< 0.05	NA	48
DUP0310041A	03/10/04	6.72	550	550	470	--	0.27	0.4	< 0.05	NA	47
1349MW102CL	03/10/04	6.72	530	530	450	--	0.28	0.45 J	< 0.05 UJ	0.45 HT-04,J	44
	12/10/03	6.60	690	690	480	2	0.29	0.09	< 0.05	NA	43
DUP1210031A	12/10/03		670	670	480	NA	0.28	0.1	< 0.05	NA	43
	08/12/03	6.92	740	740	430	1.1	0.47	0.17 b,J	< 0.1 UJ	NA	47
	06/09/03	6.80	660	660	560	1.9	0.35	0.14	< 0.1	NA	68
DUP0609032A	06/09/03	6.80	650	650	570	NM	0.34	0.11	< 0.1	NA	70
1349MW102CL	06/09/03	6.80	670	670	490	NM	0.6	0.13	< 0.05	0.13	59
1349MW103	03/15/04	7.01	490	490	830	0.52	0.42	< 0.05	< 0.1	NA	100
	12/03/03	7.70	450	450	800	1.2	0.43	< 0.1	< 0.1	NA	97
DUP1203032A	12/03/03		450	450	800	NA	0.41	< 0.1	< 0.1	NA	110
	08/12/03	7.76	400	400	790	2.4	0.54	< 0.1	< 0.1	NA	110
	06/05/03	8.20	310	310	830	1.8	0.66	< 0.1	< 0.1	NA	110
1349MW104	03/15/04	6.82	670	670	820	0.32	0.16	0.35	< 0.1	NA	62
	12/02/03	7.50	740	740	790	1	< 0.2	0.12	< 0.1	NA	58
	08/12/03	7.71	690	690	770	1.3	< 0.2	< 0.1	< 0.1	NA	55
	06/06/03	7.87	600	600	870	3	0.21	0.17	< 0.1	NA	67
1349MW105	03/15/04	7.00	240	240	590	0.31	0.41	< 0.05	< 0.1	NA	150
	12/02/03	6.40	260	260	600	1.2	0.38	< 0.05	< 0.05	NA	150
	08/12/03	8.10	280	280	600	3.1	0.48	< 0.1	< 0.1	NA	130
	06/09/03	8.00	230	230	760	1.2	0.63	< 0.1	< 0.1	NA	130

Notes
1 - The identified analytical method(s) are for analyses performed beginning in the Second Quarter 2001. The analytical methods used during previous quarters are identified in their respective quarterly report.
2 - The QC laboratory nitrate results shown have been converted to nitrate as nitrogen (nitrate-N) as other laboratory results are reported. The QC laboratory reported nitrate as NO_3 concentrations (nitrate-NO_3) which are 4.43 times higher than nitrate-N concentrations.
mg/L - milligrams per liter
NA - Not analyzed
NM - Not measured
"--" dissolved oxygen measurements were not taken for duplicate and quality control samples.
"CL" suffix denotes a quality control duplicate sample was sent to the control laboratory.
pH data included for Second Quarter 2003 through Second Quarter 2004. Data range chosen to represent monitoring periods where data exists for all Building 1349 Study Area wells based on the initiation of monitoring.

Table B-6
Results of TPH Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

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Well Name	Sample Date	TPH as Gasoline (Carbon Range C_7-C_{12})	TPH as Diesel (Carbon Range C_{12}-C_{24})	TPH as Fuel Oil (Carbon Range C_{24}-C_{36})
	Analytical Method[1]	SW8015B/ SW8015M	SW8015B/ SW8015M	SW8015B/ SW8015M
		(µg/L)	(µg/L)	(µg/L)
Cleanup Levels [2]		**770**	**880**	**1,200**
1349MW01	03/15/04	< 50	< 50	< 300
	12/02/03	< 50	< 50	< 300
	08/21/03	< 50	< 50	< 300
	06/10/03	< 50	< 50	< 300
	03/12/03	NA	< 50	< 300
	12/09/02	< 50	< 50	< 300
DUP1209021A	12/09/02	< 50	< 50	< 300
1349MW01CL	12/09/02	< 50	< 50	< 250
	08/28/02	< 50	< 50	< 300
	05/30/02	< 50	< 50	< 300
	03/06/02	< 50	< 50	< 300
	11/28/01	< 50	< 50	< 300
	08/30/01	< 50	< 50 [3]	< 300 [3]
DUP0830013A	08/30/01	< 50	57 [3] Y,NJ	< 300 [3]
1349MW01CL	08/30/01	< 50	< 50	< 300
	05/10/01	< 50	< 50	< 300
	05/19/99	NA	< 50	< 300
	02/19/99	NA	< 50	< 300
	11/18/98	NA	< 50	< 300
	08/18/98	NA	< 50 (U15)	< 300
	04/16/98	NA	< 50	< 300
	01/22/98	NA	< 50	< 300
	10/30/97	NA	< 50	< 300
	07/31/97	NA	< 50	< 300
	05/01/97	NA	< 50	< 300
	02/10/97	NA	< 50	< 300
	11/25/96	NA	< 50	< 300
	09/12/96	NA	< 50	< 300
	08/08/95	NA	< 50	NA
1349MW02	05/26/04	< 50	< 50	< 300
	03/15/04	< 50	< 50	< 300
	12/02/03	< 50	< 50	< 300
	08/13/03	< 50	290 HY	< 300
	06/05/03	< 50	< 50	< 300
DUP0605032A	06/05/03	< 50	< 50	< 300
	03/12/03	NA	< 50	< 300
	12/04/02	< 50	< 50	< 300
DUP1204023A	12/04/02	< 50	< 50	< 300
	08/28/02	< 50	< 50	< 300
	05/30/02	< 50	< 50	< 300

Table B-6
Results of TPH Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

DRAFT

Well Name	Sample Date	TPH as Gasoline (Carbon Range C_7-C_{12})	TPH as Diesel (Carbon Range C_{12}-C_{24})	TPH as Fuel Oil (Carbon Range C_{24}-C_{36})
	Analytical Method[1]	SW8015B/ SW8015M	SW8015B/ SW8015M	SW8015B/ SW8015M
		(µg/L)	(µg/L)	(µg/L)
Cleanup Levels [2]		**770**	**880**	**1,200**
1349MW02	03/06/02	< 50	< 50	< 300
DUP0306022A	03/06/02	< 50	< 50	< 300
	11/28/01	< 50	< 50	< 300
DUP1128011A	11/28/01	< 50	< 50	< 300
	08/30/01	< 50	57 [3] Y,NJ	< 300 [3]
DUP0830012A	08/30/01	< 50	67 [3] Y,NJ	< 300 [3]
1349MW02CL	08/30/01	< 50	< 50	< 300
1349MW02	05/10/01	< 50	< 50	< 300
	05/19/99	NA	< 50	< 300
	02/19/99	NA	< 50	< 300
	11/18/98	NA	< 50	< 300
	08/18/98	NA	< 50 (U15)	< 300
	04/16/98	NA	< 50	< 300
	01/22/98	NA	< 50	< 300
	10/30/97	NA	< 50	< 300
	07/31/97	NA	58 (R32)	< 300
	05/01/97	NA	< 50	< 300
	02/10/97	NA	< 50	< 300
	11/25/96	NA	< 50	< 300
	09/12/96	NA	< 50	< 300
	08/08/95	NA	< 50	NA
1349MW03	08/28/02	< 50	< 50	< 300
DUP0828022A	08/28/02	< 50	< 50	< 300
1349MW03CL	08/28/02	< 50	< 50 UJ	< 300 UJ
	05/30/02	< 50	< 50	< 300
DUP0530021A	05/30/02	< 50	< 50	< 300
1349MW03CL	05/30/02	< 50	< 50	< 300
	03/06/02	< 50	< 50	< 300
DUP0306022B	03/06/02	< 50	< 50	< 300
1349MW03CL	03/06/02	< 50	53 ndp	< 300
	11/28/01	< 50	< 50	390 H
DUP1128011B	11/28/01	< 50	< 50	< 300
1349MW03CL	11/28/01	< 50	< 50	< 500
	08/30/01	< 50	< 50 [3]	< 300 [3]
	05/10/01	< 50	< 50	< 300
	05/19/99	NA	< 50	< 300
	02/19/99	NA	< 50	< 300
	11/18/98	NA	< 50	< 300
	08/18/98	NA	< 50 (U15)	< 300
	04/16/98	NA	< 50	< 300
	01/22/98	NA	< 50	< 300
	10/30/97	NA	< 50	< 300

Table B-6
Results of TPH Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

DRAFT

Well Name	Sample Date	TPH as Gasoline (Carbon Range C_7-C_{12})	TPH as Diesel (Carbon Range C_{12}-C_{24})	TPH as Fuel Oil (Carbon Range C_{24}-C_{36})
	Analytical Method[1]	SW8015B/ SW8015M	SW8015B/ SW8015M	SW8015B/ SW8015M
		(µg/L)	(µg/L)	(µg/L)
Cleanup Levels [2]		**770**	**880**	**1,200**
1349MW03	07/31/97	NA	< 50	< 300
	05/01/97	NA	< 50	< 300
	02/10/97	NA	< 50	< 300
	11/25/96	NA	< 50	< 300
	09/12/96	NA	< 50	< 300
	08/08/95	NA	< 50	NA
1349MW03R	05/26/04	< 50	< 50	< 300
	03/09/04	< 50	81 HY	770 Z
	12/02/03	< 50	< 50	< 300
	08/13/03	< 50	< 50	< 300
	06/09/03	< 50	< 50	< 300
1349MW100	05/27/04	**920 HY**	**3,600**	< 300
	03/16/04	**930 H**	**31,000**	< 600
	12/02/03	**1,000 HY,J+**	**1,100 LY**	< 300
	08/12/03	700 YH	**9,000**	< 300
	06/09/03	**1,200 YH**	**5,100**	< 300
	03/12/03	610 YH	**1,800**	< 300
	12/10/02	230 Y	**1,500**	< 300
1349MW101	03/09/04	< 50	< 50	< 300
	12/02/03	< 50	< 50	< 300
	08/19/03	< 50	< 50	< 300
	06/09/03	< 50	< 50	< 300
1349MW102	05/27/04	< 50	51 Y	< 300
DUP0527041A	05/27/04	< 50	< 50	< 300
1349MW102CL	05/27/04	< 50	54	< 240
	03/10/04	< 50	< 50	< 300
DUP0310041A	03/10/04	< 50	< 50	< 300
1349MW102CL	03/10/04	< 50	NA	NA
	12/10/03	< 50	< 50	< 300
DUP1210031A	12/10/03	< 50	< 50	< 300
	08/12/03	< 50	< 50	< 300
	06/09/03	< 50	< 50	< 300
DUP0609032A	06/09/03	< 50	< 50	< 300
1349MW102CL	06/09/03	< 50	< 50	< 250
1349MW103	03/15/04	< 50	< 50	< 300
	12/03/03	< 50	< 50	< 300
DUP1203032A	12/03/03	< 50	< 50	< 300
	08/12/03	< 50	< 50	< 300
	06/05/03	< 50	< 50	< 300
1349MW104	03/15/04	< 50	< 50	< 300
	12/02/03	< 50	< 50	< 300
	08/12/03	< 50	< 50	< 300
	06/06/03	< 50	< 50	< 300

Table B-6
Results of TPH Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	TPH as Gasoline (Carbon Range C_7-C_{12})	TPH as Diesel (Carbon Range C_{12}-C_{24})	TPH as Fuel Oil (Carbon Range C_{24}-C_{36})
	Analytical Method[1]	SW8015B/ SW8015M	SW8015B/ SW8015M	SW8015B/ SW8015M
		(µg/L)	(µg/L)	(µg/L)
Cleanup Levels [2]		**770**	**880**	**1,200**
1349MW105	03/15/04	< 50	< 50	< 300
	12/02/03	< 50	< 50	< 300
	08/12/03	< 50	< 50	< 300
	06/09/03	< 50	< 50	< 300

Notes

1 - The identified analytical method(s) are for analyses performed beginning in the Second Quarter 2001. The analytical methods used during previous quarters are identified in the respective quarterly reports.

2- Drinking Water Cleanup Level from Table 7-6 Cleanup Levels Document (EKI, October 2002).

3 - TPH analysis was not run using the silica gel cleanup method 3630A, although it was marked on the chain of custody.

µg/L - micrograms per liter

NA - Not analyzed

TPH - Total petroleum hydrocarbons

Y - Sample exhibits fuel pattern that does not resemble the standard.

"CL" suffix denotes a quality control duplicate sample was sent to control laboratory.

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Table B-7
Results of VOC Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	2-Butanone	Acetone	Benzene	Bromo-form	Carbon Disulfide	Dibromo-chloro-methane	Ethyl-benzene	MTBE	Toluene	Total Xylenes	All Other VOCs
	Analytical Method[1]	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Cleanup Levels [2]		**4200**	**700**	**1**	**100**	**--**	**100**	**700**	**13**	**150**	**1,750**	**--**
1349MW01	03/15/04	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	12/02/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/21/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	06/10/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	03/12/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	12/09/02	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5 UJ	< 0.5	< 0.5	ND
DUP1209021A	12/09/02	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5 UJ	< 0.5	< 0.5	ND
1349MW01CL	12/09/02	< 5	< 10	< 0.5	< 0.5	< 5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/28/02	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	05/30/02	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	03/06/02	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	11/28/01	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/30/01	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP0830013A	08/30/01	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW01CL	08/30/01	< 50	< 50	< 0.5	< 1	< 0.5	< 1	< 0.5	< 5	< 0.5	< 0.5	ND
	05/10/01	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5 UJ	< 0.5	< 0.5 UJ	< 0.5 UJ	ND
	02/19/99	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	11/18/98	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	08/18/98	NA	NA	< 0.5 U18	NA	NA	NA	< 0.5 U18	NA	< 0.5 U18	< 0.5 U18	NA
	04/16/98	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	01/22/98	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	10/30/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	07/31/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	05/01/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	02/10/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	11/25/96	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	09/12/96	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	0.54	< 0.5	NA
	08/08/95	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA

Table B-7
Results of VOC Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	2-Butanone	Acetone	Benzene	Bromo-form	Carbon Disulfide	Dibromo-chloro-methane	Ethyl-benzene	MTBE	Toluene	Total Xylenes	All Other VOCs
	Analytical Method[1]	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Cleanup Levels [2]		**4200**	**700**	**1**	**100**	**--**	**100**	**700**	**13**	**150**	**1,750**	**--**
1349MW02	03/15/04	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	12/02/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/13/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	06/05/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP0605032A	06/05/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	03/12/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	12/04/02	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP1204023A	12/04/02	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/28/02	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	05/30/02	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	03/06/02	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP0306022A	03/06/02	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	11/28/01	< 10	< 10 UJ	0.8	< 1	< 0.5	< 0.5	< 0.5	< 0.5	1.5	< 0.5	ND
DUP1128011A	11/28/01	< 10	< 10	**1.1**	< 1	< 0.5	< 0.5	< 0.5	< 0.5	2.3	0.7	ND
	08/30/01	< 10	< 10	< 0.5	< 1	1.0	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP0830012A	08/30/01	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW02CL	08/30/01	< 50	< 50	< 0.5	< 1	< 0.5	< 1	< 0.5	< 5	< 0.5	< 0.5	ND
	05/10/01	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	02/19/99	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	11/18/98	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	08/18/98	NA	NA	< 0.5 U18	NA	NA	NA	< 0.5 U18	NA	< 0.5 U18	< 0.5 U18	NA
	04/16/98	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	01/22/98	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	10/30/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	07/31/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	05/01/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	02/10/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	11/25/96	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	09/12/96	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	08/08/95	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA

Table B-7
Results of VOC Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	2-Butanone	Acetone	Benzene	Bromo-form	Carbon Disulfide	Dibromo-chloro-methane	Ethyl-benzene	MTBE	Toluene	Total Xylenes	All Other VOCs
	Analytical Method[1]	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M
		(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)	(μg/L)
Cleanup Levels [2]		**4200**	**700**	**1**	**100**	**--**	**100**	**700**	**13**	**150**	**1,750**	**--**
1349MW03	12/09/02	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	08/28/02	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP0828022A	08/28/02	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW03CL	08/28/02	< 50 R	< 50	< 0.5	< 0.5	< 5	< 0.5	< 0.5	< 5	< 0.5	< 1	ND
	05/30/02	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP0530021A	05/30/02	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW03CL	05/30/02	7.9 J	< 50	< 0.5	< 0.5	< 5	< 0.5	< 0.5	< 5	< 0.5	< 1	ND
	03/06/02	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP0306022B	03/06/02	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW03CL	03/06/02	< 50	< 50	< 0.5	< 0.5	< 5	< 0.5	< 0.5	< 5	< 0.5	< 1	ND
	11/28/01	< 10	< 10 UJ	0.8	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP1128011B	11/28/01	< 10	< 10 UJ	0.8	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW03CL	11/28/01	< 50	< 50	0.7	< 0.5	< 5	< 0.5	< 0.5	< 5	< 0.5	0.9	ND
	08/30/01	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	05/10/01	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	07/21/00	< 10	< 20	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	ND
	02/19/99	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	11/18/98	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	08/18/98	NA	NA	< 0.5 U18	NA	NA	NA	< 0.5 U18	NA	< 0.5 U18	< 0.5 U18	NA
	04/16/98	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	01/22/98	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	10/30/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	07/31/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	05/01/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	02/10/97	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	11/25/96	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	09/12/96	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
	08/08/95	NA	NA	< 0.5	NA	NA	NA	< 0.5	NA	< 0.5	< 0.5	NA
1349MW03R	03/09/04	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	12/02/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/13/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	06/09/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND

Table B-7
Results of VOC Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	2-Butanone	Acetone	Benzene	Bromo-form	Carbon Disulfide	Dibromo-chloro-methane	Ethyl-benzene	MTBE	Toluene	Total Xylenes	All Other VOCs
	Analytical Method[1]	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Cleanup Levels [2]		**4200**	**700**	**1**	**100**	**--**	**100**	**700**	**13**	**150**	**1,750**	**--**
1349MW100	03/16/04	< 10	< 10	**24**	< 1	< 0.5	< 0.5	2.5	< 0.5	< 0.5	5.5	ND
	12/02/03	< 10	< 10	**7.8**	< 1	< 0.5	< 0.5	2	0.5	0.5	3.8	ND
	08/12/03	< 10	< 10	**9.1**	< 1	< 0.5	< 0.5	1.1	< 0.5	0.5	3	ND
	06/09/03	< 10	< 10	**27**	< 1	1.3	< 0.5	7	< 0.5	0.7	12	ND
	03/12/03	< 10	< 10	**25**	< 1	< 0.5 UJ	< 0.5	5	< 0.5	0.6	9.8	ND
	12/10/02	< 10	< 10	**2.6**	< 1	< 0.5	< 0.5	1.3	< 0.5 UJ	0.8	3	ND
1349MW101	03/09/04	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	12/02/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/19/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	06/09/03	< 10	< 10	< 0.5	0.6 J	< 0.5	0.6	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW102	03/10/04	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP0310041A	03/10/04	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW102CL	03/10/04	< 5	< 10 R	< 0.5	< 0.5	< 5 UJ	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	12/10/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP1210031A	12/10/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/12/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	06/09/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP0609032A	06/09/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW102CL	06/09/03	< 5	< 10	< 0.5	< 0.5	< 5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW103	03/15/04	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	12/03/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
DUP1203032A	12/03/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/12/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	06/05/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
1349MW104	03/15/04	< 10	< 10 UJ	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	12/02/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/12/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	06/06/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND

Table B-7
Results of VOC Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	2-Butanone	Acetone	Benzene	Bromoform	Carbon Disulfide	Dibromochloromethane	Ethylbenzene	MTBE	Toluene	Total Xylenes	All Other VOCs
	Analytical Method[1]	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M	SW8260/ SW8260B/ SW8260M
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Cleanup Levels [2]		**4200**	**700**	**1**	**100**	**--**	**100**	**700**	**13**	**150**	**1,750**	**--**
1349MW105	03/15/04	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	12/02/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	08/12/03	< 10	< 10	< 0.5	< 1	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND
	06/09/03	< 10	12	< 0.5	< 1	1.9	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	ND

Notes
1 - The identified analytical method(s) are for analyses performed beginning in the Second Quarter 2001. The analytical methods used during previous quarters are identified in the respective quarterly reports.
2- Drinking Water Cleanup Level from Table 7-6 Cleanup Levels Document (EKI, October 2002).
-- cleanup level not established
µg/L - micrograms per liter
ND - Not detected
NA - Not analyzed
NS - Not sampled
VOC - Volatile organic compound
MTBE - Methyl tert-butyl ether
"CL" suffix denotes a quality control duplicate sample was sent to the control laboratory.

Table B-8
Results of OCP and PCB Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	4,4'-DDD	4,4'-DDE	4,4'-DDT	Aldrin	alpha-Chlordane	beta-BHC	delta-BHC	Dieldrin	Endosulfan II	Endrin	gamma-BHC	gamma-Chlordane	Heptachlor	Heptachlor Epoxide	Methoxy-chlor	All Other OCPs and PCBs
	Analytical Method[1]	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082
Cleanup Levels (2)		0.15 a	0.1 a	0.1 a	0.05 b	0.1	0.3	--	0.5	42 a	2	0.2	0.1 b	0.025	0.025	40	
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
1349MW01	03/15/04	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	12/02/03	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.5 UJ	ND
	08/21/03	< 0.09	< 0.09	< 0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.09	< 0.09	< 0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	06/10/03	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	03/12/03	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
	12/09/02	< 0.097	< 0.097	< 0.097	< 0.049	< 0.049	< 0.049	< 0.049	< 0.097	< 0.097	< 0.097	< 0.049	< 0.049	< 0.049	< 0.049	< 0.49	ND
DUP1209021A	12/09/02	< 0.097	< 0.097	< 0.097	< 0.049	< 0.049	< 0.049	< 0.049	< 0.097	< 0.097	< 0.097	< 0.049	< 0.049	< 0.049	< 0.049	< 0.49	ND
1349MW01CL	12/09/02	< 0.1	< 0.1	< 0.1	< 0.05 UJ	NA	< 0.05 UJ	< 0.05 UJ	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.5	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
	08/28/02	< 0.097	< 0.097	< 0.097	< 0.049 UJ	< 0.049	< 0.049 UJ	< 0.049 UJ	< 0.097	< 0.097	< 0.097	< 0.049 UJ	< 0.049	< 0.049 UJ	< 0.049 UJ	< 0.49	ND
	05/30/02	< 0.098	< 0.098	< 0.098	< 0.049 UJ	< 0.049	< 0.049 UJ	< 0.049 UJ	< 0.098	< 0.098	< 0.098	< 0.049 UJ	< 0.049	< 0.049 UJ	< 0.049 UJ	< 0.49	ND
	03/06/02	< 0.098	< 0.098	< 0.098 UJ	< 0.049 UJ	< 0.049	< 0.049 UJ	< 0.049 UJ	< 0.098	< 0.098	< 0.098	< 0.049 UJ	< 0.049	< 0.049 UJ	< 0.049 UJ	< 0.49	ND
	11/28/01	< 0.096	< 0.096	< 0.096	< 0.048	< 0.048	< 0.048	< 0.048	< 0.096	< 0.096	< 0.096	< 0.048	< 0.048	< 0.048	< 0.048	< 0.48	ND
	08/30/01	< 0.097 UJ	< 0.097 UJ	< 0.097 UJ	< 0.049	< 0.049 UJ	< 0.049	< 0.049	< 0.097 UJ	< 0.097 UJ	< 0.097 UJ	< 0.049	< 0.049 UJ	< 0.049	< 0.049	< 0.49 UJ	ND
DUP0830013A	08/30/01	< 0.098	< 0.098	< 0.098	< 0.049	< 0.049	< 0.049	< 0.049	< 0.098	< 0.098	< 0.098	< 0.049	< 0.049	< 0.049	< 0.049	< 0.49	ND
1349MW01CL	08/30/01	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	ND
	05/10/01	< 0.094 UJ	< 0.094 UJ	< 0.094 UJ	< 0.047	< 0.047 UJ	< 0.047	< 0.047	< 0.094 UJ	< 0.094 UJ	< 0.094 UJ	< 0.047	< 0.047 UJ	< 0.047	< 0.047	< 0.47 UJ	ND
1349MW02	05/26/04	< 0.09	< 0.09	< 0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.09	< 0.09	< 0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	03/15/04	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	12/02/03	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	08/13/03	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	06/05/03	< 0.09	< 0.09	< 0.09 UJ	< 0.05	< 0.05	< 0.05	< 0.05	< 0.09	< 0.09	< 0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
DUP0605032A	06/05/03	< 0.09	< 0.09	< 0.09 UJ	< 0.05	< 0.05	< 0.05	< 0.05	< 0.09	< 0.09	< 0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	03/12/03	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	12/04/02	< 0.097	< 0.097	< 0.097	< 0.049	< 0.049	< 0.049	< 0.049	< 0.097	< 0.097	< 0.097	< 0.049	< 0.049	< 0.049	< 0.049	< 0.49	ND
DUP1204023A	12/04/02	< 0.094 UJ	< 0.094 UJ	< 0.094 UJ	< 0.047	< 0.047 UJ	< 0.047	< 0.047	< 0.094 UJ	< 0.094 UJ	< 0.094 UJ	< 0.047	< 0.047 UJ	< 0.047	< 0.047	< 0.47 UJ	ND
	08/28/02	< 0.095	< 0.095	< 0.095	< 0.048	< 0.048	< 0.048	< 0.048	< 0.095	< 0.095	< 0.095	< 0.048	< 0.048	< 0.048	< 0.048	< 0.48	ND
	05/30/02	< 0.099	< 0.099	< 0.099	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.099	< 0.099	< 0.099	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
	03/06/02	< 0.095	< 0.095	< 0.095 UJ	< 0.048	< 0.048	< 0.048	< 0.048	< 0.095	< 0.095	< 0.095	< 0.048 UJ	< 0.048	< 0.048	< 0.048	< 0.48	ND
DUP0306022A	03/06/02	< 0.095	< 0.095	< 0.095 UJ	< 0.048 UJ	< 0.048	< 0.048 UJ	< 0.048 UJ	< 0.095	< 0.095	< 0.095	< 0.048 UJ	< 0.048	< 0.048 UJ	< 0.048 UJ	< 0.48	ND
	11/28/01	< 0.096	< 0.096	< 0.096	< 0.048	< 0.048	< 0.048	< 0.048	< 0.096	< 0.096	< 0.096	< 0.048	< 0.048	< 0.048	< 0.048	< 0.48	ND
DUP1128011A	11/28/01	< 0.096 UJ	< 0.096 UJ	< 0.096 UJ	< 0.048	< 0.048 UJ	< 0.048	< 0.048	< 0.096 UJ	< 0.096 UJ	< 0.096 UJ	< 0.048	< 0.048 UJ	< 0.048	< 0.048	< 0.48 UJ	ND
	08/30/01	< 0.098 UJ	< 0.098 UJ	< 0.098 UJ	< 0.049	< 0.049 UJ	< 0.049	< 0.049	< 0.098 UJ	< 0.098 UJ	< 0.098 UJ	< 0.049	< 0.049 UJ	< 0.049	< 0.049	< 0.49 UJ	ND
DUP0830012A	08/30/01	< 0.097	< 0.097	< 0.097	< 0.049	< 0.049	< 0.049	< 0.049	< 0.097	< 0.097	< 0.097	< 0.049	< 0.049	< 0.049	< 0.049	< 0.49	ND
1349MW02CL	08/30/01	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	ND
	05/10/01	< 0.094	< 0.094	< 0.094	< 0.047	< 0.047	< 0.047	< 0.047	< 0.094	< 0.094	< 0.094	< 0.047	< 0.047	< 0.047	< 0.047	< 0.47	ND

Table B-8
Results of OCP and PCB Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	4,4'-DDD	4,4'-DDE	4,4'-DDT	Aldrin	alpha-Chlordane	beta-BHC	delta-BHC	Dieldrin	Endosulfan II	Endrin	gamma-BHC	gamma-Chlordane	Heptachlor	Heptachlor Epoxide	Methoxy-chlor	All Other OCPs and PCBs
	Analytical Method[1]	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082
Cleanup Levels (2)		0.15 a	0.1 a	0.1 a	0.05 b	0.1	0.3	--	0.5	42 a	2	0.2	0.1 b	0.025	0.025	40	
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
1349MW03	12/09/02	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	08/28/02	< 0.094	< 0.094	< 0.094	< 0.047 UJ	< 0.047	< 0.047 UJ	< 0.047 UJ	< 0.094	< 0.094	< 0.094	< 0.047 UJ	< 0.047	< 0.047 UJ	< 0.047 UJ	< 0.47	ND
DUP0828022A	08/28/02	< 0.094	< 0.094	< 0.094	< 0.047	< 0.047	< 0.047	< 0.047	< 0.094	< 0.094	< 0.094	< 0.047	< 0.047	< 0.047	< 0.047	< 0.47	ND
1349MW03CL	08/28/02	< 0.06	< 0.06	< 0.06	< 0.05	< 0.06	< 0.05	< 0.05	< 0.06	< 0.06	< 0.06	< 0.05	< 0.06	< 0.05	< 0.05	< 0.06	ND
	05/30/02	< 0.094	< 0.094	< 0.094	< 0.047 UJ	< 0.047	< 0.047 UJ	< 0.047 UJ	< 0.094	< 0.094	< 0.094	< 0.047 UJ	< 0.047	< 0.047 UJ	< 0.047 UJ	< 0.47	ND
DUP0530021A	05/30/02	< 0.094	< 0.094	< 0.094	< 0.047	< 0.047	< 0.047	< 0.047	< 0.094	< 0.094	< 0.094	< 0.047	< 0.047	< 0.047	< 0.047	< 0.47	ND
1349MW03CL	05/30/02	< 0.1	< 0.1	< 0.1	< 0.05	< 0.5	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.5	< 0.05	< 0.05	< 0.5	ND
	03/06/02	< 0.095	< 0.095	< 0.095 UJ	< 0.048	< 0.048	< 0.048	< 0.048	< 0.095	< 0.095	< 0.095	< 0.048 UJ	< 0.048	< 0.048	< 0.048	< 0.48	ND
DUP0306022B	03/06/02	< 0.095	< 0.095	< 0.095 UJ	< 0.048	< 0.048	< 0.048	< 0.048	< 0.095	< 0.095	< 0.095	< 0.048 UJ	< 0.048	< 0.048	< 0.048	< 0.48	ND
1349MW03CL	03/06/02	< 0.06	< 0.06	< 0.06	< 0.05	< 0.06	< 0.05	< 0.05	< 0.06	< 0.06	< 0.06	< 0.05	< 0.06	< 0.05	< 0.05	< 0.06	ND
	11/28/01	< 0.096	< 0.096	< 0.096	< 0.048	< 0.048	< 0.048	< 0.048	< 0.096	< 0.096	< 0.096	< 0.048	< 0.048	< 0.048	< 0.048	< 0.48	ND
DUP1128011B	11/28/01	< 0.094 UJ	< 0.094 UJ	< 0.094 UJ	< 0.047	< 0.047 UJ	< 0.047	< 0.047	< 0.094 UJ	< 0.094 UJ	< 0.094 UJ	< 0.047	< 0.047 UJ	< 0.047	< 0.047	< 0.47 UJ	ND
1349MW03CL	11/28/01	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	ND
	08/30/01	< 0.097	< 0.097	< 0.097	< 0.049	< 0.049	< 0.049	< 0.049	< 0.097	< 0.097	< 0.097	< 0.049	< 0.049	< 0.049	< 0.049	< 0.49	ND
	05/10/01	< 0.097 UJ	< 0.097 UJ	< 0.097 UJ	< 0.049	< 0.049 UJ	< 0.049	< 0.049	< 0.097 UJ	< 0.097 UJ	< 0.097 UJ	< 0.049	< 0.049 UJ	< 0.049	< 0.049	< 0.49 UJ	ND
	07/21/00	< 0.1	< 0.1	< 0.1	< 0.1	NA	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	NA	< 0.1	< 0.1	< 0.1	ND
1349MW03R	05/26/04	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
	03/09/04	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	0.08 C	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	12/02/03	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	08/13/03	< 0.09	< 0.09	< 0.09	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.09	< 0.09	< 0.09	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
	06/09/03	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.5 UJ	ND
1349MW100	05/27/04	< 0.2 UJ	< 0.2 UJ	0.5 C, J-	< 0.09	0.2 C, J-	< 0.09	0.2 C	0.3 J-	0.7 C, J-	0.2 J-	< 0.2	0.1 J-	0.8 C	0.2 C	< 0.9 UJ	ND
	03/16/04	< 0.09 UJ	0.7 Cb,J-	0.7 C,J-	< 0.05 UJ	0.2 J-	< 0.05 UJ	0.08 b,J-	0.3 J-	0.6 J-	0.2 J-	< 0.05 UJ	0.3 C,J-	0.8 Cb,J-	0.2 C,J-	1.2 b,J-	ND
	12/02/03	0.5 C	0.7 C	0.5 Cb,J-	< 0.05	< 0.05	3.9 C	0.06 C	0.1	< 0.09	< 0.09	2.3 C	< 0.05	< 0.05	0.2 C	< 0.5	ND
	08/12/03	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	0.2 C	0.1 J-	< 0.2	< 0.05	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	4.6 C	0.07 J-	2.6 Cb,J-	0.1	< 0.5 UJ	ND
	06/09/03	0.3 C,J-	0.3 C,J-	< 0.09 UJ	0.07 C	< 0.05 UJ	< 0.05	0.2 C	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	4.5 C	0.4 C,J-	< 0.05	< 0.05	< 0.5 UJ	ND
	03/12/03	0.3 Cb,J+	< 0.1 UJ	0.2 C,J-	0.3 C,J+	0.2 C,J-	6.1 C,J+	0.1 C,J+	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	2.2 C,J+	0.2 C,J-	0.8 C,J+	0.3 C J+	< 0.5 UJ	ND
	12/10/02	< 0.097	< 0.097	< 0.097	0.11 C,J-	< 0.049	1.5 C,J-	< 0.049 UJ	< 0.097	< 0.097	< 0.097	0.43 C,J-	< 0.049	0.83 C,J-	< 0.049 UJ	< 0.49	ND
1349MW101	03/09/04	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	0.06 C	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	12/02/03	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	08/19/03	< 0.09	< 0.09	< 0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.09	< 0.09	< 0.09	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	06/09/03	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.09 UJ	ND

Table B-8
Results of OCP and PCB Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	**Sample Date**	**4,4'-DDD**	**4,4'-DDE**	**4,4'-DDT**	**Aldrin**	**alpha-Chlordane**	**beta-BHC**	**delta-BHC**	**Dieldrin**	**Endosulfan II**	**Endrin**	**gamma-BHC**	**gamma-Chlordane**	**Heptachlor**	**Heptachlor Epoxide**	**Methoxy-chlor**	**All Other OCPs and PCBs**
	Analytical Method[1]	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082	SW8081/ SW8081A/ SW8082
Cleanup Levels (2)		0.15 a	0.1 a	0.1 a	0.05 b	0.1	0.3	--	0.5	42 a	2	0.2	0.1 b	0.025	0.025	40	
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
1349MW102	05/27/04	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
DUP0527041A	05/27/04	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
1349MW102CL	05/27/04	< 0.098	< 0.098	< 0.098	< 0.049	NA	< 0.049	< 0.049	< 0.098	< 0.098	< 0.098	< 0.049	< 0.49	< 0.049	< 0.049	< 0.49	ND
	03/10/04	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
DUP0310041A	03/10/04	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
1349MW102CL	03/10/04	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	NA	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.5 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	ND
	12/10/03	< 0.1	< 0.1	< 0.1 b,UJ	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	0.07 C,J+	< 0.05	< 0.05 b,UJ	< 0.05	< 0.5 b,UJ	ND
DUP1210031A	12/10/03	< 0.09	< 0.09	< 0.09 b,UJ	< 0.05	< 0.05	< 0.05	< 0.05	< 0.09	< 0.09	< 0.09	0.07 J+	< 0.05	< 0.05 b,UJ	< 0.05	< 0.5 b,UJ	ND
1349MW102	08/12/03	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05 UJ	< 0.05	< 0.5	ND
	06/09/03	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.5 UJ	ND
DUP0609032A	06/09/03	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.5 UJ	ND
1349MW102CL	06/09/03	< 0.095 UJ	< 0.095 UJ	< 0.095 UJ	< 0.048 UJ	NA	< 0.048 UJ	< 0.048 UJ	< 0.095 UJ	< 0.095 UJ	< 0.095 UJ	< 0.048 UJ	< 0.48 UJ	< 0.048 UJ	< 0.048 UJ	< 0.48 UJ	ND
1349MW103	03/15/04	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	12/03/03	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
DUP1203032A	12/03/03	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	08/12/03	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
	06/05/03	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	ND
1349MW104	03/15/04	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.5 UJ	ND
	12/02/03	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	08/12/03	< 0.09	< 0.09	< 0.09	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.09	< 0.09	< 0.09	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
	06/06/03	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05	< 0.05 UJ	< 0.05	< 0.05	< 0.5 UJ	ND
1349MW105	03/15/04	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.09 UJ	< 0.09 UJ	< 0.09 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	ND
	12/02/03	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.1	< 0.1	< 0.1	< 0.05	< 0.05	< 0.05	< 0.05	< 0.5	ND
	08/12/03	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.1	< 0.1	< 0.1	< 0.05 UJ	< 0.05	< 0.05 UJ	< 0.05 UJ	< 0.5	ND
	06/09/03	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.05 UJ	< 0.5 UJ	ND

Notes

1 - The identified analytical method(s) are for analyses performed beginning in the Second Quarter 2001. The analytical methods used during previous quarters are identified in the respective quarterly reports.

2- Drinking Water Cleanup Level from Table 7-6 Cleanup Levels Document (EKI, October 2002).

a) Values obtained from Environmental Screening Levels (ESLs) for Drinking Water (RWQCB, 2003b)

b) Value is laboratory reporting limit.

µg/L - micrograms per liter

ND - Not detected

NA - Not analyzed

OCPs - Organochlorine pesticides

PCBs - Polychlorinated biphenyls

"CL" suffix denotes a quality control duplicate sample was sent to the control laboratory.

Table B-9
Results of PAH Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	Anthracene	Benzo(a)-Anthracene	Benzo(g,h,i)-Perylene	Chrysene	Dibenz(a,h)-Anthracene	Fluor-anthene	Fluorene	Indeno-(1,2,3-c,d)-Pyrene	Naph-thalene	Phen-anthrene	Pyrene	All Other PAHs
	Analytical Method[1]	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Cleanup Level [2]		**770**	**0.1**	**150**	**20**	**--**	**300**	**300**	**--**	**300**	**230**	**230**	**--**
1349MW01	03/15/04	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
	12/02/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	08/21/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	06/10/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.96	< 0.13	< 0.96	< 0.48	< 0.19	ND
	03/12/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.96	< 0.13	< 0.96	< 0.48	< 0.19	ND
	12/09/02	< 0.49	< 0.1	< 0.19	< 0.1	< 0.19	< 0.39	< 0.97	< 0.14	< 0.97	< 0.49	< 0.19	ND
DUP1209021A	12/09/02	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
1349MW01CL	12/09/02	< 0.05	< 0.05	< 0.1	< 0.05	< 0.2	< 0.1	< 0.1	< 0.05	< 0.5	< 0.05	< 0.05	ND
	08/28/02	< 0.5	< 0.1	< 0.2	< 0.1	< 0.2	< 0.4	< 0.99	< 0.14	< 0.99	< 0.5	< 0.2	ND
	05/30/02	< 0.49	< 0.1	< 0.2	< 0.1	< 0.2	< 0.39	< 0.98	< 0.14	< 0.98	< 0.49	< 0.2	ND
	03/06/02	< 0.49	< 0.1	< 0.19	< 0.1	< 0.19	< 0.39	< 0.97	< 0.14	< 0.97	< 0.49	< 0.19	ND
	11/28/01	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.96	< 0.13	< 0.96	< 0.48	< 0.19	ND
	08/30/01	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
DUP0830013A	08/30/01	< 0.53	< 0.11	< 0.19	< 0.11	< 0.19	< 0.43	< 1.1	< 0.13	< 1.1	< 0.53	< 0.21	ND
1349MW01CL	08/30/01	< 0.05	< 0.1	< 0.1	< 0.1	< 0.1	< 0.15	< 0.1	< 0.1	< 0.15	< 0.1	< 0.15	ND
	05/10/01	< 0.48 UJ	< 0.1 UJ	< 0.19 UJ	< 0.1 UJ	< 0.19 UJ	< 0.38 UJ	< 0.95 UJ	< 0.13 UJ	< 0.95 UJ	< 0.48 UJ	< 0.19 UJ	ND
1349MW02	03/15/04	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
	12/02/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	08/13/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	06/05/03	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
DUP0605032A	06/05/03	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
	03/12/03	< 0.49	< 0.1	< 0.19	< 0.1	< 0.19	< 0.39	< 0.97	< 0.14	< 0.97	< 0.49	< 0.19	ND
	12/04/02	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
DUP1204023A	12/04/02	< 0.49	< 0.1	< 0.2	< 0.1	< 0.2	< 0.39	< 0.98	< 0.14	< 0.98	< 0.49	< 0.2	ND
	08/28/02	< 0.49	< 0.1	< 0.2	< 0.1	< 0.2	< 0.39	< 0.98	< 0.14	< 0.98	< 0.49	< 0.2	ND
	05/30/02	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
1349MW02	03/06/02	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
DUP0306022A	03/06/02	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	11/28/01	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.96	< 0.13	< 0.96	< 0.48	< 0.19	ND
DUP1128011A	11/28/01	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.96	< 0.13	< 0.96	< 0.48	< 0.19	ND
	08/30/01	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
DUP0830012A	08/30/01	< 0.51	< 0.1	< 0.19	< 0.1	< 0.19	< 0.41	< 1	< 0.13	< 1	< 0.51	< 0.2	ND
1349MW02CL	08/30/01	< 0.05	< 0.1	< 0.1	< 0.1	< 0.1	< 0.15	< 0.1	< 0.1	< 0.15	< 0.1	< 0.15	ND
	05/10/01	< 0.49 UJ	< 0.1	< 0.19	< 0.1	< 0.19	< 0.39	< 0.97	< 0.14	< 0.97	< 0.49	< 0.19	ND

Table B-9
Results of PAH Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	Anthracene	Benzo(a)-Anthracene	Benzo(g,h,i)-Perylene	Chrysene	Dibenz(a,h)-Anthracene	Fluor-anthene	Fluorene	Indeno-(1,2,3-c,d)-Pyrene	Naph-thalene	Phen-anthrene	Pyrene	All Other PAHs
	Analytical Method[1]	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Cleanup Level [2]		**770**	**0.1**	**150**	**20**	**--**	**300**	**300**	**--**	**300**	**230**	**230**	**--**
1349MW03	12/09/02	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	08/28/02	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
DUP0828022A	08/28/02	< 0.49	< 0.1	< 0.2	< 0.1	< 0.2	< 0.39	< 0.98	< 0.14	< 0.98	< 0.49	< 0.2	ND
1349MW03CL	08/28/02	< 0.05 UJ	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.1 UJ	< 0.15 UJ	< 0.1 UJ	< 0.1 UJ	< 0.15 UJ	< 0.1 UJ	< 0.15 UJ	ND
	05/30/02	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
DUP0530021A	05/30/02	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
1349MW03CL	05/30/02	< 0.05	< 0.1	< 0.1	< 0.1	< 0.1	< 0.15	< 0.1	< 0.1	< 0.15	< 0.1	< 0.15	ND
	03/06/02	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
DUP0306022B	03/06/02	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
1349MW03CL	03/06/02	< 0.05	< 0.1	< 0.1	< 0.1	< 0.1	< 0.15	< 0.1	< 0.1	< 0.15	< 0.1	< 0.15	ND
	11/28/01	< 0.48	< 0.1	0.28	< 0.1	0.36	< 0.38	< 0.96	0.17	< 0.96	< 0.48	< 0.19	ND
DUP1128011B	11/28/01	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.96	< 0.13	< 0.96	< 0.48	< 0.19	ND
1349MW03CL	11/28/01	< 0.05	< 0.1	< 0.1	< 0.1	< 0.1	< 0.15	< 0.1	< 0.1	< 0.15	< 0.1	< 0.15	ND
	08/30/01	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.96	< 0.13	< 0.96	< 0.48	< 0.19	ND
	05/10/01	< 0.49 UJ	< 0.1	< 0.19	< 0.1	< 0.19	< 0.39	< 0.97	< 0.14	< 0.97	< 0.49	< 0.19	ND
	07/21/00	< 9.6	< 9.6	< 9.6	< 9.6	< 9.6	< 9.6	< 9.6	< 9.6	< 9.6	< 9.6	< 9.6	ND
1349MW03R	03/09/04	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
	12/02/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	08/13/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	06/09/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.96	< 0.13	< 0.96	< 0.48	< 0.19	ND
1349MW100	03/16/04	< 9.4	**6.2**	< 3.8	2.7	< 3.8	14	46	< 2.6	< 19	86	< 3.8	ND
	12/02/03	0.59 J,J+	< 0.1	< 0.19	0.32 J+	< 0.19	0.96 J+	11 J+	< 0.13	< 0.95	9.6 J+	0.28 J+	ND
	08/12/03	1.1 J+	< 0.1	< 0.19	0.81 J+	< 0.19	1.7 J+	19 J+	< 0.13	< 0.95	18 J+	0.51 J+	ND
	06/09/03	< 0.47	**0.53 J+**	< 0.19	1 J+	< 0.19	2.4 J+	13 J+	< 0.13	7.5 J+	17 J+	0.75 J+	ND
	03/12/03	< 0.49	**0.14**	< 0.2	0.16	< 0.2	< 0.39	5.2	< 0.14	< 0.98	5.3	0.27	ND
	12/10/02	0.25 J	**0.15**	< 0.19	0.17	< 0.19	0.43	4	< 0.13	< 0.94	4.2	0.23	ND
1349MW101	03/09/04	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	12/02/03	< 0.49	< 0.1	< 0.19	< 0.1	< 0.19	< 0.39	< 0.97	< 0.14	< 0.97	< 0.49	< 0.19	ND
	08/19/03	< 0.48 UJ	< 0.1 UJ	< 0.19 UJ	< 0.1 UJ	< 0.19 UJ	< 0.38 UJ	< 0.95 UJ	< 0.13 UJ	< 0.95 UJ	< 0.48 UJ	< 0.19 UJ	ND
	06/09/03	< 0.47 UJ	< 0.09 UJ	< 0.19 UJ	< 0.09 UJ	< 0.19 UJ	< 0.38 UJ	< 0.94 UJ	< 0.13 UJ	< 0.94 UJ	< 0.47 UJ	< 0.19 UJ	ND
1349MW102	03/10/04	< 0.49	< 0.1	< 0.2	< 0.1	< 0.2	< 0.39	< 0.98	< 0.14	< 0.98	< 0.49	< 0.2	ND
DUP0310041A	03/10/04	< 0.49	< 0.1	< 0.19	< 0.1	< 0.19	< 0.39	< 0.97	< 0.14	< 0.97	< 0.49	< 0.19	ND
1349MW102CL	03/10/04	< 0.05	< 0.05	< 0.1 UJ	< 0.05	< 0.2 UJ	< 0.1	< 0.1	< 0.05 UJ	< 0.5	< 0.05	< 0.05	ND
	12/10/03	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
DUP1210031A	12/10/03	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
	08/12/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	06/09/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
DUP0609032A	06/09/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.96	< 0.13	< 0.96	< 0.48	< 0.19	ND
1349MW102CL	06/09/03	< 0.048	< 0.048	< 0.095	< 0.048	< 0.19	< 0.095	< 0.095	< 0.048	< 0.48	< 0.048	< 0.048	ND

Table B-9
Results of PAH Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	Anthracene	Benzo(a)-Anthracene	Benzo(g,h,i)-Perylene	Chrysene	Dibenz(a,h)-Anthracene	Fluor-anthene	Fluorene	Indeno-(1,2,3-c,d)-Pyrene	Naph-thalene	Phen-anthrene	Pyrene	All Other PAHs
	Analytical Method[1]	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310	SW8310
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Cleanup Level [2]		**770**	**0.1**	**150**	**20**	**--**	**300**	**300**	**--**	**300**	**230**	**230**	**--**
1349MW103	03/15/04	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	12/03/03	< 0.47	< 0.09	< 0.19	0.16	< 0.19	0.1 J	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
DUP1203032A	12/03/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	08/12/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.96	< 0.13	< 0.96	< 0.48	< 0.19	ND
	06/05/03	0.1 J	< 0.1	< 0.19	0.16	< 0.19	0.25 J	< 0.95	< 0.13	< 0.95	0.84	< 0.19	ND
1349MW104	03/15/04	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
	12/02/03	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
	08/12/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	06/06/03	< 0.47	< 0.09	< 0.19	< 0.09	< 0.19	< 0.38	< 0.94	< 0.13	< 0.94	< 0.47	< 0.19	ND
1349MW105	03/15/04	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	12/02/03	< 0.49	< 0.1	< 0.19	< 0.1	< 0.19	< 0.39	< 0.97	< 0.14	< 0.97	< 0.49	< 0.19	ND
	08/12/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	< 0.38	< 0.95	< 0.13	< 0.95	< 0.48	< 0.19	ND
	06/09/03	< 0.48	< 0.1	< 0.19	< 0.1	< 0.19	0.02 J	< 0.95	< 0.13	< 0.96	< 0.48	< 0.19	ND

Notes

1 - The identified analytical method(s) are for analyses performed beginning in the Second Quarter 2001. The analytical methods used during previous quarters are identified in the respective quarterly reports.

2- Drinking Water Cleanup Level from Table 7-6 Cleanup Levels Document (EKI, October 2002).

-- cleanup level not established

µg/L - micrograms per liter

ND - Not detected

NS - Not sampled

PAHs - Polycyclic aromatic hydrocarbons

"CL" suffix denotes a quality control duplicate sample was sent to control laboratory.

Table B-10
Results of Chlorinated Herbicide Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	2,4-D	2,4-DB	All Other Chlorinated Herbicides
	Analytical Method[1]	SW8151/ SW8151A	SW8151/ SW8151A	SW8151/ SW8151A
		(μg/L)	(μg/L)	(μg/L)
1349MW01	03/15/04	< 0.24 U	< 0.96 U	ND
	12/02/03	< 0.24 U	< 0.96 U	ND
	08/21/03	< 0.25	< 1	ND
	06/10/03	< 0.24	< 0.96	ND
1349MW02	08/12/04	< 0.24 U UJ	< 0.96 U UJ	ND
	05/26/04	< 0.24 U	< 0.96 U	ND
	03/15/04	< 0.24 U	< 0.96 U	ND
	12/02/03	< 0.24 U	< 0.96 U	ND
	08/13/03	< 0.24	< 0.96	ND
	06/05/03	< 0.24	< 0.96	ND
DUP0605032A	06/05/03	< 0.24	< 0.96	ND
1349MW03R	08/10/04	< 0.24 U	< 0.96 U	ND
	05/26/04	< 0.24 U	< 0.96 U	ND
	03/09/04	< 0.24 U	< 0.96 U	ND
	12/02/03	< 0.24 U	< 0.96 U	ND
	08/13/03	< 0.24	< 0.96	ND
	06/09/03	< 0.24	< 0.96	ND
1349MW100	08/10/04	< 0.24 U	< 0.96 U	ND
	05/27/04	< 0.24 U	< 0.96 U	ND
	03/16/04	< 0.24 U	< 0.96 U	ND
	12/02/03	< 0.24 U	< 0.96 U	ND
	08/12/03	2.1	12	ND
	06/09/03	< 0.24	< 0.96	ND
1349MW101	03/09/04	< 0.24 U	< 0.96 U	ND
	12/02/03	< 0.24 U	< 0.96 U	ND
	08/19/03	< 0.24	< 0.96	ND
	06/09/03	< 0.24	< 0.96	ND

Table B-10
Results of Chlorinated Herbicide Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	2,4-D	2,4-DB	All Other Chlorinated Herbicides
	Analytical Method[1]	SW8151/ SW8151A	SW8151/ SW8151A	SW8151/ SW8151A
		(µg/L)	(µg/L)	(µg/L)
1349MW102	08/10/04	< 0.24 U	< 0.96 U	ND
DUP0810042A	08/10/04	< 0.24 U	< 0.96 U	ND
	05/27/04	< 0.24 U	< 0.96 U	ND
DUP0527041A	05/27/04	< 0.24 U	< 0.96 U	ND
1349MW102CL	05/27/04	< 0.24	< 0.24	ND
	03/10/04	< 0.24 U	< 0.96 U	ND
1349MW102CL	03/10/04	< 0.25 UJ	< 0.25 UJ	ND
	12/10/03	< 0.24 U	< 0.96 U	ND
DUP1210031A	12/10/03	< 0.24 U	< 0.96 U	ND
	08/12/03	< 0.25	< 1	ND
	06/09/03	< 0.24	< 0.96	ND
DUP0609032A	06/09/03	< 0.24	< 0.96	ND
1349MW102CL	06/09/03	< 0.24 UJ	< 0.24 UJ	ND
1349MW103	03/15/04	< 0.24 U	< 0.96 U	ND
	12/03/03	< 0.24 U	< 0.96 U	ND
DUP1203032A	12/03/03	< 0.24 U	< 0.96 U	ND
	08/12/03	< 0.25	< 1	ND
	06/05/03	< 0.24	< 0.96	ND
1349MW104	03/15/04	< 0.24 U	< 0.96 U	ND
	12/02/03	< 0.24 U	< 0.96 U	ND
	08/12/03	< 0.25	< 1	ND
	06/06/03	< 0.24	< 0.96	ND
1349MW105	03/15/04	< 0.24 U	< 0.96 U	ND
	12/02/03	< 0.24 U	< 0.96 U	ND
	08/12/03	< 0.25	< 1	ND
	06/09/03	< 0.24	< 0.96	ND

Notes
1 - The identified analytical method(s) are for analyses performed beginning in the Second Quarter 2001.
The analytical methods used during previous quarters are identified in the respective quarterly reports.
µg/L - micrograms per liter
ND - Not detected
"CL" suffix denotes a quality control duplicate sample was sent to the control laboratory.

Table B-11
Results of Dissolved Metals Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium [2]	Cobalt	Copper	Hexavalent Chromium [2]	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Total Dissolved Solids
	Analytical Method [1]	SW6010/ SW6020	SW6020	SW6020	SW6010/ SW6020	SW6020	SW6020	SW6010/ SW6020	SW6020	SW6020	SW6020	SW7196/ SW7196A	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW7470/ SW7470A	SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	E160.1
Cleanup Level[3]		--	6	10	1000	4	5	--	50	140 a	1000	21 a	--	15	--	--	2	100	--	50	50	--	2	15 a	5000	
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(mg/L)
1349MW01	03/15/04	< 100	< 1	< 5	34 J-	< 2	< 1	110,000	< 10	< 10	3	NA	270	< 3	210,000	< 10	< 0.2	< 20	1,800	< 5	< 1	250,000	< 1	< 10	< 20	1,650
	12/02/03	< 100	< 1	< 5	38	< 2	< 1	86,000	< 10	< 10	1.3	NA	370	< 3	180,000	< 10	< 0.2	< 20	1,900	< 5	< 1 UJ	200,000	< 1	< 10	< 20	1,240
	08/21/03	< 100	< 1	< 5	39	< 2	< 1	94,000	< 10	< 10	< 1	NA	610	< 3	200,000	< 10	< 0.2	< 20	1,700	5.3	< 1 UJ	200,000	< 1	< 10	< 20 UJ	1,660
	06/10/03	< 100	< 1	< 5	38	< 2	< 1	100,000	< 10	< 10	< 1	NA	150	< 3	180,000	12	< 0.2	< 20	1,900	< 5	< 1	170,000	< 1	< 10	< 20	1,650
	12/09/02	< 100	< 1	< 1	44	< 1	< 1	100,000	8.2	< 1	< 1	< 10	330	< 3	210,000	10 J	0.22	6.9	2,100	< 5	< 1 UJ	200,000	< 1	< 10	< 10	1,490
DUP1209021A	12/09/02	< 100	< 1	< 1	46	< 1	< 1	100,000	10	< 1	< 1	< 10	320	< 3	210,000	12 J	< 0.2	11	2,100	< 5	< 1 UJ	190,000	< 1	< 10	< 10	1,580
1349MW01CL	12/09/02	< 300	< 5	**14**	46	< 1	< 1	110,000 J+	7.3	< 7	6.5	< 5	< 150	< 3	240,000	11	< 0.2	12	2,600	6.1	< 1	210,000	< 2	< 10	< 10	1,600
	08/28/02	< 100	< 1	< 1	280	< 1	< 1	110,000	1.2 J	< 1	1.3	< 10	180	< 3	230,000	< 10	< 0.2	3.8	2,000	< 5	< 1 UJ	230,000	< 1	< 10	30	1,750
	05/30/02	< 100	< 1	< 1	42	< 1	< 1	100,000	3.2	< 1	1.2	< 10 UJ	200	< 3	210,000	< 10	< 0.2	4.3	2,000	< 5	< 1 UJ	210,000	< 1	< 10	< 10	1,670
	03/06/02	< 100	1.1	1.1	450	< 1	< 1	130,000	3.8	< 1	1.4	< 10	480	< 3	270,000	< 10	< 0.2	5.6	2,200	< 5	1.8 J-	290,000	< 1	< 10	90	1,660
	11/28/01	< 100	< 1	1.9	590	< 1	< 1	120,000	27 J	< 1	3.4	< 10	< 100	< 3	250,000	15	< 0.2	8.8	2,500	11	< 1	240,000	< 1	< 10	200	1,610
	08/30/01	< 100	1.6	< 1	470 J+	< 1	< 1	98,000	16	< 1	2.7	< 10 UJ	300	< 3	260,000	15	< 0.2	14	2,300	< 5	< 1 UJ	210,000	< 1	< 10	98	NA
DUP0830013A	08/30/01	< 100	< 1	< 1	110 J+	< 1	< 1	98,000	15	< 1	2	< 10 UJ	300	< 3	260,000	15	< 0.2	17	1,800	< 5	< 1 UJ	210,000	< 1	< 10	13	NA
1349MW01CL	08/30/01	< 200	0.53 J	< 2	110	< 1	< 1	100,000	7.2	0.97 J	1.5 J	< 10	< 200	< 5	220,000	16	< 0.2	6.7	2,600	7.4	< 1	260,000	< 5	< 5	19	2,100
	05/10/01	< 100	< 1	1.3	620	< 1	< 1	110,000	10 J	< 1	4.6 J	< 10 UJ	840	< 3	230,000	11	< 0.2	5.4 J	2,700	5.9	< 1 UJ	220,000	< 1	< 10	180 J	1,690 J
	05/19/99	< 100	NA	NA	NA	NA	NA	107,000	NA	NA	< 10	NA	< 100	NA	240,000	< 10	NA	NA	< 5,000	NA	NA	203,000	NA	NA	NA	1,900
	02/19/99	< 100	NA	NA	NA	NA	NA	101,000	NA	NA	< 10	NA	< 100	NA	234,000	< 10	NA	NA	< 5,000	NA	NA	193,000	NA	NA	NA	1,800
	11/18/98	< 100	NA	NA	NA	NA	NA	96,900	NA	NA	< 10	NA	< 100	NA	237,000	< 10	NA	NA	< 5,000	NA	NA	190,000	NA	NA	NA	1,640
	08/18/98	< 100	NA	NA	NA	NA	NA	102,000	NA	NA	11.8	NA	< 100	NA	248,000	< 10	NA	NA	< 5,000	NA	NA	197,000	NA	NA	NA	1,900
	04/16/98	< 100	NA	NA	NA	NA	NA	100,000	NA	NA	28.4	< 10 (U16)	< 100	NA	222,000	< 10	NA	NA	< 5,000	NA	NA	200,000	NA	NA	NA	1,980
	01/22/98	< 100	NA	NA	NA	NA	NA	94,900	NA	NA	< 10	NA	< 100	NA	238,000	13.4	NA	NA	< 5,000	NA	NA	182,000	NA	NA	NA	1,830
	10/30/97	< 100	NA	NA	NA	NA	NA	97,000	NA	NA	< 20	NA	< 100	NA	237,000	24.2	NA	NA	< 5,000	NA	NA	178,000	NA	NA	NA	1,950
	07/31/97	< 100	NA	NA	NA	NA	NA	93,200	NA	NA	< 20	NA	< 100	NA	221,000	14.2	NA	NA	< 5,000	NA	NA	190,000	NA	NA	NA	1,650
	05/01/97	< 100	NA	NA	NA	NA	NA	110,000	NA	NA	< 10	NA	< 100	NA	263,000	29	NA	NA	3,040	NA	NA	191,000	NA	NA	NA	1,830
	02/10/97	< 100	NA	NA	NA	NA	NA	118,000	NA	NA	5.1	NA	< 100	NA	260,000	34	NA	NA	< 5,000	NA	NA	234,000	NA	NA	NA	2,090
1349MW02	08/12/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,620
	05/26/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,620
	03/15/04	< 100	< 1	< 5	230 J-	< 2	< 1	85,000	**83**	< 10	1.8	NA	190	< 3	270,000	< 10	< 0.2	< 20	< 500	< 5	< 1	230,000	< 1	< 10	< 20	1,600
	12/02/03	< 100	1.3	< 5	170	< 2	< 1	57,000	**75**	< 10	1.1	NA	220	< 3	270,000	< 10	< 0.2	< 20	< 500	< 5	< 1 UJ	200,000	< 1	< 10	< 20	1,160
	08/13/03	< 100	1.7	< 5	180	< 2	< 1	61,000	**87**	< 10	< 1	NA	300	< 3	230,000	< 10	< 0.2	< 20	< 500	< 5	< 1 UJ	190,000	< 1	< 10	< 20	1,540
	06/05/03	< 100	1.3	< 5	180	< 2	< 1	59,000	**80**	< 10	1.2	NA	150	< 3	250,000	< 10	0.26	< 20	530	< 5	< 1	210,000	< 1	< 10	< 20	1,440
DUP0605032A	06/05/03	< 100	1.3	< 5	180	< 2	< 1	65,000	**83**	< 10	< 1	NA	100	< 3	240,000	< 10	< 0.2	< 20	< 500	< 5	< 1	190,000	< 1	< 10	< 20	1,500
	12/04/02	< 100	< 1	< 1	160	< 1	< 1	53,000	**92**	< 1	< 1	80	160	< 3	220,000	< 10	< 0.2	6.3	< 500	< 5	< 1 UJ	180,000	< 1	< 10	< 10	1,600
DUP1204023A	12/04/02	< 100	< 1	< 1	160	< 1	< 1	52,000	**94**	< 1	1.1	80	160	< 3	220,000	< 10	< 0.2	6.6	< 500	< 5	< 1 UJ	180,000	< 1	< 10	< 10	1,400
	08/28/02	< 100	1.2	< 1	510	< 1	< 1	55,000	**82 J**	< 1	1.4	90	< 100	< 3	240,000	< 10	< 0.2	6.2	660	< 5	< 1 UJ	210,000	< 1	< 10	68	1,500
	05/30/02	< 100	< 1	< 1	460	< 1	< 1	61,000	**79**	< 1	1.4	70 J-	< 100	< 3	230,000	< 10	< 0.2	5.1	690	< 5	< 1 UJ	200,000	< 1	< 10	87	1,610
	03/06/02	< 100	< 1	< 1	340	< 1	< 1	90,000	**95**	< 1	< 1	90	310	< 3	270,000	< 10	< 0.2	7	580	< 5	< 1 UJ	240,000	< 1	< 10	< 10	1,610
DUP0306022A	03/06/02	< 100	< 1	< 1	390	< 1	< 1	96,000	**97**	< 1	< 1	90 J-	310	< 3	290,000	< 10	< 0.2	7.2	600	< 5	< 1 UJ	260,000	< 1	< 10	16	1,580
	11/28/01	< 100	< 1	1.2	760	< 1	< 1	51,000	**130 J**	< 1	2.7	100	< 100	< 3	260,000	< 10	< 0.2	8.2	1,100	5.1	< 1	220,000	< 1	< 10	190	1,510
DUP1128011A	11/28/01	< 100	< 1	1	350	< 1	< 1	52,000	**130 J**	< 1	2.1	100 J	< 100	< 3	260,000	< 10	< 0.2	8.4	900	< 5	< 1	220,000	< 1	< 10	30	1,470
	08/30/01	< 100	< 1	< 1	150 J+	< 1	< 1	45,000	**110**	< 1	1.8	< 10	150	< 3	250,000	< 10	< 0.2	6.9	< 500	< 5	< 1 UJ	210,000	< 1	< 10	< 10	1,550
DUP0830012A	08/30/01	< 100	< 1	< 1	160 J+	< 1	< 1	47,000	**100**	< 1	1.9	< 10	150	< 3	260,000	< 10	< 0.2	6.6	<500	< 5	< 1 UJ	210,000	< 1	< 10	15	1,470
1349MW02CL	08/30/01	< 200	1.2 J	< 2	800	< 1	< 1	47,000	**110**	0.92 J	1.7 J	90	< 200	< 5	230,000	< 5	< 0.2	8.3	<1,000	7.9	< 1	280,000	< 1	< 5	170	1,900
	05/10/01	< 100	< 1	1.1	560	< 1	< 1	49,000	**98 J**	< 1	4.2 J	70 J	390	<3	250,000	< 10	< 0.2	9.3 J	780	< 5	< 1 UJ	210,000	< 1	< 10	160 J	1,620 J

Table B-11
Results of Dissolved Metals Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium 2	Cobalt	Copper	Hexavalent Chromium 2	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Total Dissolved Solids
	Analytical Method [1]	SW6010/ SW6020	SW6020	SW6020	SW6010/ SW6020	SW6020	SW6020	SW6010/ SW6020	SW6020	SW6020	SW6020	SW7196/ SW7196A	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW7470/ SW7470A	SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	E160.1
Cleanup Level[3]		--	6	10	1000	4	5	--	50	140 a	1000	21 a	--	15	--	--	2	100	--	50	50	--	2	15 a	5000	
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(mg/L)
1349MW02	05/19/99	< 100	NA	NA	NA	NA	NA	57,300	NA	NA	< 10	NA	< 100	NA	274,000	< 10	NA	NA	< 5,000	NA	NA	204,000	NA	NA	NA	1,900
	02/19/99	< 100	NA	NA	NA	NA	NA	63,500	NA	NA	< 10	NA	< 100	NA	284,000	< 10	NA	NA	< 5,000	NA	NA	215,000	NA	NA	NA	1,840
	11/18/98	< 100	NA	NA	NA	NA	NA	59,300	NA	NA	18.7	NA	< 100	NA	283,000	< 10	NA	NA	< 5,000	NA	NA	213,000	NA	NA	NA	1,770
	08/18/98	< 100	NA	NA	NA	NA	NA	57,800	NA	NA	< 10	NA	< 100	NA	267,000	< 10	NA	NA	< 5,000	NA	NA	211,000	NA	NA	NA	1,900
	04/16/98	< 100	NA	NA	NA	NA	NA	53,500	NA	NA	< 10	43 (J16)	< 100	NA	233,000	< 10	NA	NA	< 5,000	NA	NA	195,000	NA	NA	NA	1,760
	01/22/98	< 100	NA	NA	NA	NA	NA	50,800	NA	NA	< 10	NA	< 100	NA	244,000	< 10	NA	NA	< 5,000	NA	NA	196,000	NA	NA	NA	1,750
	10/30/97	< 100	NA	NA	NA	NA	NA	52,300	NA	NA	< 20	NA	< 100	NA	244,000	< 10	NA	NA	< 5,000	NA	NA	199,000	NA	NA	NA	1,750
	07/31/97	< 100	NA	NA	NA	NA	NA	51,300	NA	NA	< 20	NA	< 100	NA	249,000	< 10	NA	NA	< 5,000	NA	NA	205,000	NA	NA	NA	1,810
	05/01/97	< 100	NA	NA	NA	NA	NA	53,900	NA	NA	< 10	NA	< 100	NA	266,000	< 10	NA	NA	< 1,000	NA	NA	188,000	NA	NA	NA	1,700
	02/10/97	< 100	NA	NA	NA	NA	NA	39,600	NA	NA	2.5	NA	< 100	NA	176,000	19.7	NA	NA	< 5,000	NA	NA	145,000	NA	NA	NA	1,490
1349MW03	08/28/02	< 100	< 1	< 1	170	< 1	< 1	23,000	**99 J**	< 1	< 1	110	< 100	< 3	130,000	< 10	< 0.2	5	< 500	< 5	< 1 UJ	60,000	< 1	< 10	25	680
DUP0828022A	08/28/02	< 100	< 1	< 1	370	< 1	< 1	23,000	**110 J**	< 1	< 1	100	< 100	< 3	130,000	< 10	< 0.2	5.1	< 500	< 5	< 1 UJ	59,000	< 1	< 10	62	710
1349MW03CL	08/28/02	54 J	< 2	< 2	74	< 1	< 1	23,000	**110 B**	0.4 J	< 2 BJ,U	90	30 J	NA	120,000	2.7 J	< 0.2	5.9	400 J	9.3	< 1	55,000	< 1	2.8 J	18	790
	05/30/02	< 100	< 1	< 1	84	< 1	< 1	22,000	**99**	< 1	< 1	90 J-	< 100	< 3	120,000	< 10	< 0.2	4.7	< 500	< 5	< 1 UJ	53,000	< 1	< 10	19	720
DUP0530021A	05/30/02	< 100	1	< 1	190	< 1	< 1	23,000	**98**	< 1	< 1	90 J-	< 100	< 3	130,000	< 10	< 0.2	5	< 500	< 5	< 1 UJ	56,000	< 1	< 10	69	740
1349MW03CL	05/30/02	< 100	0.36 J	< 2	120 B	< 1	<1 BJ,U	23,000	**98 J+**	0.38 J	1.8 BJ	100	< 100	< 5	120,000	6.9	< 0.2	5.5 B	660 J	< 5	< 1	51,000	< 1	2.4 J	39	740 J-
	03/06/02	< 100	< 1	< 1	95	< 1	< 1	28,000	**100**	< 1	< 1	100	< 100	< 3	160,000	< 10	< 0.2	5.2	< 500	< 5	< 1 UJ	70,000	< 1	< 10	12	720
DUP0306022B	03/06/02	< 100	< 1	< 1	74	< 1	< 1	28,000	**100**	< 1	< 1	100	< 100	< 3	160,000	< 10	< 0.2	5.4	< 500	< 5	< 1 UJ	70,000	< 1	< 10	< 10	720
1349MW03CL	03/06/02	< 200	0.55 J	0.57 J	290	< 2	0.081 J	24,000	**100**	0.43 J	1.7 BJ	100	36 J	< 5	130,000	< 5	NA	5.1	< 1,000	6.3	< 1	53,000	< 1	< 5	43 B	870
	11/28/01	< 100	< 1	< 1	260	< 1	< 1	26,000	**120 J**	< 1	13	110	< 100	< 3	180,000	< 10	< 0.2	6.5	< 500	< 5	< 1	68,000	< 1	< 10	41	760
DUP1128011B	11/28/01	< 100	1	< 1	680	< 1	< 1	27,000	**120 J**	< 1	1.7	110	< 100	< 3	140,000	< 10	< 0.2	6.6	930	< 5	< 1	72,000	< 1	< 10	170	770
1349MW03CL	11/28/01	< 200	0.11 J	< 2	80	< 1	< 1	23,000	**110**	0.46 J	1.4 BJ	110	< 200	< 5	130,000	< 5	< 0.2	5.8	< 1,000	5.2	< 1	58,000	< 1	< 5	16 B	770
	08/30/01	< 100	< 1	< 1	170 J+	< 1	< 1	25,000	**110**	< 1	1.3	< 10	< 100	< 3	160,000	< 10	< 0.2	5.4	< 500	< 5	< 1 UJ	67,000	< 1	< 10	47	850
	05/10/01	< 100	2.3	< 1	530	< 1	< 1	26,000	**110 J**	< 1	2.5 J	90	200	< 3	150,000	< 10	< 0.2	7 J	<500	< 5	< 1 UJ	66,000	< 1	< 10	86 J	860 J
	07/21/00	NA	<60	< 5	<17	< 2	< 5	NA	**70**	< 20	< 10	80	NA	< 3	NA	NA	< 0.2	< 20	NA	< 5	< 5	NA	< 5	< 10	< 20	NA
	05/19/99	< 100	NA	NA	NA	NA	NA	26,800	NA	NA	< 10	NA	< 100	NA	149,000	< 10	NA	NA	< 5,000	NA	NA	58,300	NA	NA	NA	863
	02/19/99	< 100	NA	NA	NA	NA	NA	21,100	NA	NA	< 10	NA	< 100	NA	116,000	< 10	NA	NA	< 5,000	NA	NA	46,300	NA	NA	NA	747
	11/18/98	< 100	NA	NA	NA	NA	NA	23,900	NA	NA	< 10	NA	< 100	NA	138,000	< 10	NA	NA	< 5,000	NA	NA	64,300	NA	NA	NA	832
	08/18/98	< 100	NA	NA	NA	NA	NA	26,000	NA	NA	< 10	NA	< 100	NA	139,000	< 10	NA	NA	< 5,000	NA	NA	54,300	NA	NA	NA	795
	04/16/98	< 100	NA	NA	NA	NA	NA	23,700	NA	NA	< 10	69 (J16)	< 100	NA	128,000	< 10	NA	NA	< 5,000	NA	NA	49,700	NA	NA	NA	667
	01/22/98	< 100	NA	NA	NA	NA	NA	21,200	NA	NA	< 10	NA	< 100	NA	106,000	< 10	NA	NA	< 5,000	NA	NA	40,200	NA	NA	NA	616
	10/30/97	< 100	NA	NA	NA	NA	NA	23,100	NA	NA	< 20	NA	< 100	NA	130,000	< 10	NA	NA	< 5,000	NA	NA	59,400	NA	NA	NA	912
	07/31/97	< 100	NA	NA	NA	NA	NA	23,200	NA	NA	< 20	NA	< 100	NA	131,000	< 10	NA	NA	< 5,000	NA	NA	57,400	NA	NA	NA	806
	05/01/97	< 100	NA	NA	NA	NA	NA	25,300	NA	NA	< 10	NA	< 100	NA	151,000	< 10	NA	NA	< 1,000	NA	NA	52,800	NA	NA	NA	836
	02/10/97	< 100	NA	NA	NA	NA	NA	21,200	NA	NA	2.6	NA	37.2	NA	106,000	< 10	NA	NA	< 5,000	NA	NA	38,800	NA	NA	NA	825
1349MW03R	08/10/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	540
	05/26/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	580
	03/09/04	< 100	< 1	< 5	< 10	< 2	< 1	23,000	**94**	< 10	< 1	NA	< 100	< 3	84,000	< 10	< 0.2	< 20	3000 J	< 5	< 1 UJ	67,000	< 1	< 10	< 20	550
	12/02/03	< 100	1.9	5.4	< 10	< 2	< 1	18,000	42	< 10	< 1	NA	< 100	< 3	68,000	< 10	< 0.2	< 20	4,400	< 5	< 1 UJ	56,000	< 1	< 10	< 20	360
	08/13/03	< 100	3.3	7.4	< 10	< 2	< 1	24,000	**59**	< 10	< 1	NA	120	< 3	70,000	< 10	< 0.2	< 20	6,100	< 5	< 1 UJ	63,000	< 1	< 10	< 20	510
	06/09/03	< 100	1.4	6.2	< 10	< 2	< 1	30,000	44	< 10	< 1	NA	< 100	< 3	60,000	< 10	< 0.2	< 20	9,700	< 5	< 1 UJ	100,000	< 1	< 10	< 20	690
1349MW100	08/10/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2450
	05/26/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2490
	03/16/04	< 100	1.8	**11**	600 J-	< 2	< 1	150,000	< 10	< 10	1.3	NA	30,000	< 3	210,000	16,000	< 0.2	< 20	2,800	< 5	< 1	440,000	< 1	< 10	< 20	2050
	12/02/03	< 100	2.6	**23**	530	< 2	< 1	170,000	16	< 10	1.3	NA	36,000	< 3	290,000	15,000	< 0.2	< 20	3,900	< 5	< 1 UJ	380,000	< 1	< 10	< 20	1,820
	08/12/03	< 100	< 1	**15 J+**	700	< 2	< 1	160,000	15 J	< 10	< 1	NA	21,000	< 3	250,000	160	< 0.2	< 20	3,400	< 5	< 1 UJ	350,000	< 1	< 10	< 20 UJ	2,450
	06/09/03	< 100	1.9	**14**	520	< 2	< 1	130,000	10	< 10	< 1	NA	25,000	< 3	190,000	14,000	< 0.2	< 20	2,900	< 5	< 1 UJ	370,000	< 1	< 10	< 20	2,200
1349MW100	03/12/03	< 100	< 1	7.9	680	< 1	< 1	140,000	7.2	8.9	< 1	< 10	13,000	< 3	190,000	14,000	< 0.2	15	2,600	< 5	< 1 UJ	330,000 J-	< 1	< 10	< 10	2,100
	12/10/02	< 100	< 1	5.9	300	< 1	< 1	190,000	12	33	1.3	< 10	4,600	< 3	290,000	6,600 J	< 0.2	28	7,600	< 5	< 1 UJ	300,000	< 1	< 10	< 10	2,480
1349MW101	03/09/04	< 100	1.3	5.2	< 10	< 2	< 1	23,000	45	< 10	< 1	NA	< 100	< 3	61,000	< 10	< 0.2	< 20	4300 J	< 5	< 1 UJ	99,000	< 1	< 10	< 20	590
	12/02/03	< 100	1.8	< 5	< 10	< 2	< 1	20,000	15	< 10	< 1	NA	< 100	< 3	54,000	24	< 0.2	< 20	6,300	< 5	< 1 UJ	120,000	< 1	< 10	< 20	390
	08/19/03	< 100	< 1	5.9	< 10	< 2	< 1	29,000	15	< 10	< 1	NA	120	< 3	57,000	19	< 0.2	< 20	7,500	< 5	< 1 UJ	150,000	< 1	< 10	< 20 UJ	660
	06/09/03	< 100	< 1	6.1	< 10	< 2	< 1	36,000	34	< 10	< 1	NA	< 100	< 3	56,000	< 10	< 0.2	< 20	9,800	< 5	< 1 UJ	160,000	< 1	< 10	< 20	890

Table B-11
Results of Dissolved Metals Analyses in Groundwater
Building 1349
Presidio of San Francisco, California

Well Name	Sample Date	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium 2	Cobalt	Copper	Hexavalent Chromium 2	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Total Dissolved Solids
	Analytical Method [1]	SW6010/ SW6020	SW6020	SW6020	SW6010/ SW6020	SW6020	SW6020	SW6010/ SW6020	SW6020	SW6020	SW6020	SW7196/ SW7196A	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW7470/ SW7470A	SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	SW6010/ SW6020	E160.1
Cleanup Level[3]		--	6	10	1000	4	5	--	50	140 a	1000	21 a	--	15	--	--	2	100	--	50	50	--	2	15 a	5000	
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(mg/L)
1349MW102	08/10/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,160
DUP0810042A	08/10/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,260
	05/26/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,270
DUP0527041A	05/26/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,220
1349MW102CL	05/26/04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,100
	03/10/04	< 100	< 1	< 5	83	< 2	< 1	73,000	< 10	< 10	< 1	NA	290	< 3	160,000	430	< 0.2	< 20	3,400	< 5	< 1 UJ	160,000	< 1	< 10	< 20	1,150
DUP0310041A	03/10/04	< 100	< 1	< 5	81	< 2	< 1	77,000	< 10	< 10	< 1	NA	260	< 3	160,000	400	< 0.2	< 20	3,300	< 5	< 1 UJ	170,000	< 1	< 10	< 20	1,280
1349MW102CL	03/10/04	< 100	< 5	5.6	77	< 1	< 1	76,000	< 10	< 7	< 10	NA	640	< 3	170,000	420	< 0.2	< 10	3,600	< 5	< 1	170,000	< 2	< 10	< 20	1,100 QB01
	12/10/03	< 100	< 1	< 5	69	< 2	< 1	77,000	< 10	< 10	< 1	NA	420	< 3	160,000	550	< 0.2	< 20	3,800	< 5 R	< 1	160,000	< 1	< 10	< 20 UJ	1,260
DUP1210031A	12/10/03	< 100	1.8	< 5	72	< 2	< 1	80,000	< 10	< 10	1	NA	460	< 3	170,000	600	< 0.2	< 20	4,000	< 5 R	< 1	170,000	< 1	< 10	< 20 UJ	1,090
	08/12/03	< 100	2.7	< 5 UJ	34	< 2	< 1	100,000	< 10 UJ	< 10	< 1	NA	390	< 3	180,000	550	< 0.2	< 20	6,400	< 5	< 1 UJ	190,000	< 1	< 10	< 20 UJ	1,430
	06/09/03	< 100	< 1	< 5	31	< 2	< 1	100,000	< 10	< 10	< 1	NA	210	< 3	190,000	440	< 0.2	< 20	9,800	< 5	< 1 UJ	230,000	< 1	< 10	< 20	1,620
DUP0609032A	06/09/03	< 100	2.9	< 5	32	< 2	< 1	98,000	< 10	< 10	< 1	NA	260	< 3	200,000	450	< 0.2	< 20	9,600	< 5	< 1 UJ	220,000	< 1	< 10	< 20	1,630
1349MW102CL	06/09/03	< 100	< 5	7.3	31	< 1	< 1	110,000	< 5	1.4	< 5	NA	530	< 3	180,000	340	< 0.2	7.4	11,000	< 5	< 1	240,000	< 2	< 10	23	1,900 HT-RA,J-
1349MW103	03/15/04	< 100	< 1	< 5	11 J-	< 2	< 1	88,000	< 10	< 10	1.2	NA	210	< 3	320,000	280	< 0.2	**180**	6,800	< 5	< 1	200,000	< 1	< 10	< 20	1,650
	12/03/03	< 100	< 1	< 5	< 10	< 2	< 1	75,000	< 10	< 10	1	NA	360	< 3	250,000	260	< 0.2	**110**	7,800	< 5	< 1 UJ	190,000	< 1	< 10	< 20	1,450
DUP1203032A	12/03/03	< 100	3.6	< 5	< 10	< 2	< 1	74,000	< 10	< 10	< 1	NA	370	< 3	250,000	250	< 0.2	**100**	7,500	< 5	< 1 UJ	190,000	< 1	< 10	< 20	1,440
	08/12/03	< 100	2.2	< 5 UJ	< 10	< 2	< 1	72,000	< 10 UJ	< 10	< 1	NA	270	< 3	240,000	190	< 0.2	**100**	8,400	< 5	< 1 UJ	190,000	< 1	< 10	< 20 UJ	1,590
	06/05/03	< 100	3	< 5	17	< 2	< 1	72,000	< 10	< 10	1	NA	170	< 3	190,000	160	< 0.2	42	13,000	< 5	< 1	190,000	< 1	< 10	< 20	1,520
1349MW104	03/15/04	< 100	< 1	< 5	49 J-	< 2	< 1	82,000	40	< 10	1.5	NA	190	< 3	320,000	56	< 0.2	< 20	4,200	< 5	< 1	280,000	< 1	< 10	< 20	1,800
	12/02/03	< 100	2.2	5.8	38	< 2	< 1	65,000	49	< 10	1.4	NA	280	< 3	280,000	80	< 0.2	< 20	4,800	< 5	< 1 UJ	240,000	< 1	< 10	< 20	780
	08/12/03	< 100	2.3	6 J+	35	< 2	< 1	73,000	12 J	< 10	< 1	NA	360	< 3	260,000	530	< 0.2	< 20	5,800	< 5	< 1 UJ	240,000	< 1	< 10	< 20 UJ	1,000
	06/06/03	< 100	1.5	< 5	50	< 2	< 1	76,000	< 10	< 10	< 1	NA	190	< 3	260,000	970	< 0.2	32	8,300	< 5	< 1	270,000	< 1	< 10	< 20	1,870
1349MW105	03/15/04	< 100	1.5	**12**	47 J-	< 2	< 1	86,000	< 10	< 10	1.1	NA	360	< 3	180,000	310	< 0.2	< 20	11,000	< 5	< 1	150,000	< 1	< 10	< 20	1,260
	12/02/03	< 100	1.7	**10**	36	< 2	< 1	75,000	11	< 10	< 1	NA	600	< 3	160,000	340	< 0.2	< 20	13,000	< 5	< 1 UJ	140,000	< 1	< 10	< 20	850
	08/12/03	< 100	2.5	**12 J+**	54	< 2	< 1	79,000	< 10 UJ	< 10	< 1	NA	590	< 3	150,000	380	< 0.2	< 20	15,000	< 5	< 1 UJ	160,000	< 1	< 10	< 20 UJ	920
	06/09/03	< 100	4.5	**10**	41	< 2	< 1	82,000	< 10	< 10	< 1	NA	440	< 3	180,000	350	< 0.2	< 20	16,000	< 5	< 1 UJ	200,000	< 1	< 10	< 20	1,480

Notes
1 - The identified analytical method(s) are for analyses performed beginning in the Second Quarter 2001. The analytical methods used during previous quarters are identified in the respective quarterly reports.
2 - Results of Army and Trust studies support the hypothesis that dissolved chromium and hexavalent chromium measured in groundwater in upland areas of the Presidio appear to be naturally occurring and derived from serpentinite.
Hexavalent chromium was not retained as a COC (Treadwell and Rollo, 2002e).
3- Drinking Water Cleanup Level from Table 7-6 Cleanup Levels Document (EKI, October 2002).
a) Values obtained from Environmental Screening Levels (ESLs) for Drinking Water (RWQCB, 2003b)
Groundwater samples collected from all site monitoring wells were field filtered and analyzed for dissolved metals.
µg/L - micrograms per liter
mg/L - milligrams per liter
NA - Not analyzed
"CL" suffix denotes a quality control duplicate sample was sent to the control laboratory.

Appendix C

Previous Investigation Summary (From Others)

Table 10-2
Excavation Soil Analytical Results, Section MT-6
Fuel Distribution System Removal Report

Presidio of San Francisco

Sample Designation (depth)[a] date	Petroleum Hydrocarbons by EPA 8015 Modified[b] (mg/kg[c])		Total Petroleum Hydrocarbons by Immunoassay (mg/kg)	Carcinogenic PAHs[d] by EPA 8310[b] (mg/kg)						Total PAHs by Immunoassay (mg/kg)
	Diesel Range (C12-C24)	Fuel Oil Range (C24-C36)		Benzo(a)-anthracene	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Chrysene	Total Carcinogenic	
FM06039T01 (5.0) 10/24/96	NA[e]	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM06039T02 (6.0) 10/24/96	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM06040T01 (3.0) 10/24/96	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM06040T02 (3.5) 10/24/96	NA	NA	115	NA	NA	NA	NA	NA	NA	<5.0
FM06041T01 (3.6) 10/16/96	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM06041T02 (3.0) 10/24/96	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM06042T01 (3.0) 10/16/96	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM06042T02 (3.0) 10/16/96	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM06043W01 (7.0) 2/25/97	NA	NA	<1,380	NA	NA	NA	NA	NA	NA	5.0
FM06043W02 (7.0) 2/25/97	NA	NA	>1,380	NA	NA	NA	NA	NA	NA	>5.0
FM06043W03 (8.5) 2/25/97	NA	NA	>1,380	NA	NA	NA	NA	NA	NA	>5.0
FM06043W04 (4.0) 2/25/97	1,400	1,800	>1,380	<0.018	0.36	<0.018	<0.018	<0.018	0.36	>5.0
FM06043W05 (6.5) 2/25/97	NA	NA	>1,380	NA	NA	NA	NA	NA	NA	>5.0

[a](depth) - Sample depth in feet below original ground surface
[b]U.S. Environmental Protection Agency, 1996, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Washington, DC.
[c]mg/kg - milligrams per kilogram
[d]PAHs - polycyclic aromatic hydrocarbons
[e]NA - not analyzed

checked by: C.P. 5/24/9?
approved by: [signature] 5-21-95

Source: IT, 1999. *Fuel Distribution System Closure Report, Presidio of San Francisco, California, Volumes 1 through 3*. May. Shaded values represent exceedence of cleanup level.

Table 10-3
Stockpile Soil Analytical Results, Section MT-6
Fuel Distribution System Removal Report

Presidio of San Francisco

Sample Designation	Collection Date	Total Petroleum Hydrocarbons by Immunoassay (mg/kg[a])	Total PAHs[b] by Immunoassay (mg/kg)	Petroleum Hydrocarbons by EPA 8015 Modified[c] (mg/kg)	
				Diesel Range (C10-C24)	Fuel Oil Range (C24-C36)
FM06040S01	10/30/96	<100	<5.0	NA[d]	NA
FM06040S02	10/30/96	<71	<1	NA	NA
FM06040S03	10/30/96	<100	<5.0	NA	NA
FM06040S04	10/30/96	<71	<1	NA	NA
FM0643S01	10/16/96	<71	<1.3	82	<540
FM0643S02[e]	10/16/96	<71	<1.7	51	**250**
FM0644S01	10/10/96	>71	>1	NA	NA

[a]mg/kg - milligrams per kilogram
[b]PAHs - Polycyclic Aromatic Hydrocarbons
[c]U.S. Environmental Protection Agency, 1996, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Washington, DC.
[d]NA - not analyzed
[e]FM0643S02 - duplicate of FM0643S01

checked by: Tom Burg 4/14/99
approved by: [illegible] 5-20-99

Source: IT, 1999. *Fuel Distribution System Closure Report, Presidio of San Francisco, California, Volumes 1 through 3*. May. Shaded values represent exceedence of cleanup level.

Table 11-2
Excavation Soil Analytical Results, Section MT-7
Fuel Distribution System Removal Report

Presidio of San Francisco
(Page 2 of 3)

Sample Designation (depth) date	Petroleum Hydrocarbons by EPA 8015 Modified (mg/kg)		Total Petroleum Hydrocarbons by Immunoassay (mg/kg)	Carcinogenic PAHs by EPA 8310 (mg/kg)						Total PAHs by Immunoassay (mg/kg)
	Diesel Range (C12-C24)	Fuel Oil Range (C24-C36)		Benzo(a)-anthracene	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Chrysene	Total Carcinogenic	
FM07045T03 (4.0) 11/12/96	NA	NA	<575	NA	NA	NA	NA	NA	NA	<5.0
FM07045T04 (4.0) 11/12/96	NA	NA	<575	NA	NA	NA	NA	NA	NA	<5.0
FM07045T05 (3.5) 4/1/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07046T01 (2.5) 3/20/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07046T02 (2.5) 4/15/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07046T03 (1.5) 4/16/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07047T01 (2.0) 3/24/97	NA	NA	<575	NA	NA	NA	NA	NA	NA	<5.0
FM07047T02 (2.5) 4/15/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07047T03 (1.5) 4/16/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07048T01 (2.5) 3/25/97	NA	NA	115	NA	NA	NA	NA	NA	NA	<5.0
FM07048T02 (2.5) 4/15/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07048T03 (1.5) 4/16/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07049T01 (2.5) 3/25/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07049T02 (2.0) 4/17/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07049T03 (2.0) 4/22/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0

Source: IT, 1999. *Fuel Distribution System Closure Report, Presidio of San Francisco, California, Volumes 1 through 3*. May. Shaded values represent exceedence of cleanup level.

Table 11-2
Excavation Soil Analytical Results, Section MT-7
Fuel Distribution System Removal Report
Presidio of San Francisco

(Page 1 of 3)

Sample Designation (depth)[a] date	Petroleum Hydrocarbons by EPA 8015 Modified[b] (mg/kg[c])		Total Petroleum Hydrocarbons by Immunoassay (mg/kg)	Carcinogenic PAHs[d] by EPA 8310[b] (mg/kg)						Total PAHs by Immunoassay (mg/kg)
	Diesel Range (C12-C24)	Fuel Oil Range (C24-C36)		Benzo(a)-anthracene	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Chrysene	Total Carcinogenic	
FM07043T02 (3.0) 10/16/96	NA[e]	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07043T03 (5.0) 10/22/96	NA	NA	<1,380	NA	NA	NA	NA	NA	NA	5.0
FM07044T08 (4.5) 10/22/96	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07044T09 (5.0) 11/12/96	NA	NA	<575	NA	NA	NA	NA	NA	NA	<5.0
FM07044T11 (4.5) 11/12/96	NA	NA	<575	NA	NA	NA	NA	NA	NA	<5.0
FM07044T13 (5.0) 11/12/96	NA	NA	115	NA	NA	NA	NA	NA	NA	<5.0
FM07044T14 (6.0) 11/12/96	NA	NA	<575	NA	NA	NA	NA	NA	NA	<5.0
FM07044W01 (6.5) 2/24/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07044W02 (6.5) 2/24/97	NA	NA	>6,856	NA	NA	NA	NA	NA	NA	>5.0
FM07044W03 (6.5) 2/24/97	NA	NA	>6,856	NA	NA	NA	NA	NA	NA	>5.0
FM07044W04 (3.5) 2/24/97	NA	NA	<139	NA	NA	NA	NA	NA	NA	<5.0
FM07044W05 (4.0) 2/25/97	NA	NA	>1,380	NA	NA	NA	NA	NA	NA	<5.0
FM07044W06 (4.0) 2/25/97	NA	NA	<575	NA	NA	NA	NA	NA	NA	<5.0
FM07044W07 (4.0) 2/25/97	NA	NA	<691	NA	NA	NA	NA	NA	NA	<5.0
FM07044W08 (4.0) 2/25/97	NA	NA	>1,380	NA	NA	NA	NA	NA	NA	>5.0
FM07044W09 (3.5) 2/25/97	1,300	1,800	>1,380	<0.018	0.30	<0.018	<0.018	<0.018	0.30	>5.0
FM07044W10 (7.0) 2/26/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0

Source: IT, 1999. *Fuel Distribution System Closure Report, Presidio of San Francisco, California, Volumes 1 through 3*. May. Shaded values represent exceedence of cleanup level.

Table 11-2
Excavation Soil Analytical Results, Section MT-7
Fuel Distribution System Removal Report

Presidio of San Francisco
(Page 3 of 3)

Sample Designation (depth) date	Petroleum Hydrocarbons by EPA 8015 Modified (mg/kg)		Total Petroleum Hydrocarbons by Immunoassay (mg/kg)	Carcinogenic PAHs by EPA 8310 (mg/kg)						Total PAHs by Immunoassay (mg/kg)
	Diesel Range (C12-C24)	Fuel Oil Range (C24-C36)		Benzo(a)-anthracene	Benzo(a)-pyrene	Benzo(b)-fluoranthene	Benzo(k)-fluoranthene	Chrysene	Total Carcinogenic	
FM07050T01 (2.5) 3/25/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07050T02 (2.0) 4/17/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07050T03 (2.0) 4/22/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0
FM07051T02 (2.0) 4/17/97	NA	NA	<115	NA	NA	NA	NA	NA	NA	<5.0

[a](depth) - Sample depth in feet below original ground surface
[b]U.S. Environmental Protection Agency, 1996, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Washington, DC.
[c]mg/kg - milligrams per kilogram
[d]PAHs - polycyclic aromatic hydrocarbons
[e]NA - not analyzed

checked by: C.P. 5/24/99
approved by: [signature] 5-20-99

Source: IT, 1999. *Fuel Distribution System Closure Report, Presidio of San Francisco, California, Volumes 1 through 3*. May. Shaded values represent exceedence of cleanup level.

Table 11-3
Stockpile Soil Analytical Results, Section MT-7
Fuel Distribution System Removal Report

Presidio of San Francisco

Sample Designation	Collection Date	Total Petroleum Hydrocarbons by Immunoassay (mg/kg[a])	Total PAHs[b] by Immunoassay (mg/kg)
FM07046S01	4/15/97	<62.5	<1.0
FM07046S02	4/16/97	<62.5	<1.0
FM07048S01	4/21/97	62.5	1.0
FM07049S01	4/21/97	<62.5	<1.0

[a]mg/kg - milligrams per kilogram
[b]PAHs - Polycyclic Aromatic Hydrocarbons

checked by: Tom Berg 4/14/99

approved by: [illegible] 5·20·99

Source: IT, 1999. *Fuel Distribution System Closure Report, Presidio of San Francisco, California, Volumes 1 through 3*. May. Shaded values represent exceedence of cleanup level.

TABLE 4-1
SOIL SAMPLE RESULTS - ORGANICS PRESIDIO OF SAN FRANCISCO, BUILDING 1349
(From Montgomery Watson, January 1995)

			BTEX (EP A 8240)			
Soil Boring	Depth (bgs)	TPH-Extractable (EP A 8015 - modified)	Benzene (ug/kg)	Toluene (ug/kg)	Ethylbenzene (ug/kg)	Xylene (ug/kg)
1349SB01	1	220Ja	<5.0	<1.0	<5.0	<5.0
1349SB01	5	1.3Ja	<5.0	<1.0	<5.0	<5.0
1349SB01	10	6.5 J a	<5.0	<1.0	<5.0	<5.0
1349SB01	13	2.2 J a	<5.0	<1.0	<5.0	<5.0
1349SB02	4	240 J	<5.0	<0.50	<5.0	<5.0
1349SB02	5	7.7 J a	<5.0	<1.0	<5.0	<5.0
1349SB02	10	<1.2	<5.0	<1.0	<5.0	<5.0
1349SB03	1	63 J a	<5.0	<0.50	<5.0	<5.0
1349SB03	5	1.2 J a	<5.0	<0.50	<5.0	<5.0
1349SB03	10	<1.1	<5.0	<0.50	<5.0	<5.0
1349SB03	15	<1.1	<5.0	<0.50	<5.0	<5.0
1349SB03	20	<1.1	<5.0	<0.50	<5.0	<5.0
1349SB04	1	2.3 J a	<5.0	<0.50	<5.0	<5.0
1349SB04	4	1.8 J a	<5.0	<0.50	<5.0	<5.0
1349SB05	1	980 J a	<5.0	<0.50	<5.0	<5.0
1349SB05	5	9,100	<25	<0.50	220	1,900
1349SB05	10.8	6.4	<5.0	<0.50	<5.0	<5.0
1349SB06	1	64,000 J a	<6.2	<0.62	<6.2	<6.2
1349SB06	5	13,000	<27	<0.54	320	2,000
1349SB06	10	7,900	<25	<0.50	220	1,700
1349SB06	16.5	<1.1	<5.4	<0.54	<5.4	<5.4
1349SB07	1	170,000 J a	<25	<0.50	68	1,100
1349SB07	5	3,700	<25	<0.50	90	610
1349SB07	10	2,700	<25	<0.50	130	940
1349SB07	15	2,500	<25	<0.50	40	310
1349SB08	1	4 J a	<6.1	<0.61	<6.1	<6.1
1349SB08	4.5	2.7 J a	<5.8	<0.58	<5.8	<5.8
1349SB08	10	4 J a	<6.2	<0.62	<6.2	<6.2
1349SB08	16.5	<1.1	<5.3	<0.53	<5.3	<5.3
1349SB09	0.5	4.6 J a	<5.5	<0.55	<5.5	<5.5
1349SB09	2	3.4 J a	<5.5	<0.55	<5.5	<5.5
1349SB09	5	1.5 J a	<5.3	<0.53	<5.3	<5.3
1349SB09	10	<1.1	<5.4	<0.54	<5.4	<5.4
1349SB09	15	<1.1	<5.5	<0.55	<5.5	<5.5
1349SB09	20	2.4 J a	<5.5	<0.55	<5.5	<5.5
1349SB10	1	160 J a	<5.0	<0.50	<5.0	<5.0
1349SB10	3	1.5Ja	<5.0	<0.50	<5.0	<5.0
1349SB10	5	1.4 J a	<5.0	<0.50	<5.0	<5.0
1349SB10	6	1.1Ja	<5.0	<0.50	<5.0	<5.0
1349SB10	10	2.5 J a	<5.0	<0.50	<5.0	<5.0
1349SB11	1	59,000	<31	<0.61	280	230
1349SB11	5	1,900 -	<28	<1.1	180	1,200
1349SB11	9	2,000	<28	<0.56	89	620

TABLE 4-1

SOIL SAMPLE RESULTS - ORGANICS PRESIDIO OF SAN FRANCISCO, BUILDING 1349

(From Montgomery Watson, January 1995)

Soil Boring	Depth (bgs)	TPH-Extractable (EP A 8015 - modified)	BTEX (EP A 8240) Benzene (ug/kg)	Toluene (ug/kg)	Ethylbenzene (ug/kg)	Xylene (ug/kg)
1349SB12	1	13 J a	<5.0	<0.50	<5.0	<5.0
1349SB12	5	4,000	<500	<0.50	620	8,300
1349SB12	10	5,300	<25	<0.50	150	1,400
1349SB12	15	3,100	<25	<0.50	99	760
1349SB12	20	2.6 J a	<5.0	<0.50	<5.0	<5.0
1349SB13	1	21 J a	<5.8	<1.2	<5.8	<5.8
1349SB13	5	4,300	<30	<0.61	250	210
1349SB13	10	1,500	<27	<0.54	72	550
1349SB14	1.5	77 J a	<6.0	<6.0	<6.0	<6.0
1349SB14	5	2.8 J a	<5.4	<5.4	<5.4	<5.4
1349SB14	10	17 Ja	<5.4	<5.4	<5.4	<5.4
1349SB14	15	1.1Ja	<5.3	<5.3	<5.3	<5.3
1349SB15	1.5	19 J a	<5.8	<5.8	<5.8	<5.8
1349SB15	5	4.4 J a	<5.4	<5.4	<5.4	<5.4
1349SB15	10	2.5 J a	<5.2	<5.2	<5.2	<5.2
1349SB16	1	9.6 J a	<5.6	<5.6	<5.6	<5.6
1349SB16	5	<1.1	<5.6	<5.6	<5.6	7.3
1349SB16	10	<1.1	<5.5	<5.5	<5.5	<5.5
1349SB16	15	<1.1	<5.6	<5.6	<5.6	<5.6
1349SB16	20	1.3 J a	<5.6	<5.6	<5.6	<5.6
1349SB17	1	16 J a	<5.4	<5.4	<5.4	<5.4
1349SB17	5	2Ja	<5.6	<5.6	<5.6	<5.6
1349SB17	10	1.9 J a	<5.5	<5.5	<5.5	<5.5
1349SB17	15	1.1Ja	<5.4	<5.4	<5.4	<5.4
1349SB17	20	<1.1	<5.3	<5.3	<5.3	<5.3
1349SB18	1	9.5 J a	<5.8	<5.8	<5.8	<5.8
1349SB18	5	2.2 J a	<5.7	<5.7	<5.7	<5.7
1349SB18	10	1.3 J a	<5.4	<5.4	<5.4	13
1349SB18	15	<1.1 J a	<5.7	<5.7	<5.7	<5.7
1349SB19	1	4.6 J a	<5.4	<5.4	<5.4	<5.4
1349SB19	5	1.6 J a	<5.7	<5.7	<5.7	<5.7
1349SB19	10.5	1.4 J a	<5.3	<5.3	<5.3	<5.3
1349SB19	15.5	1.1 Ja	<5.2	<5.2	<5.2	<5.2
1349SB20	1.5	18 J a	<5.5	<5.5	<5.5	<5.5
1349SB20	5	1.6 J a	<5.7	<5.7	<5.7	<5.7
1349SB20	10	1.3 J a	<5.7	<5.7	<5.7	<5.7
1349SB20	15	1.1 Ja	<5.5	<5.5	<5.5	<5.5
1349SB20	20	1.6 J a	<5.6	<5.6	<5.6	<5.6
1349SB21	2	15,000	<570	1,100	2,600	20,000
1349SB21	5	5,400	<61	130	840	4,600
1349SB21	10	1,700 -	<55	110	240	2,000
1349SB21	15	1,400	<56	64	150	1,300
1349SB21	20	1,300	<55	<55	100	580
1349SB21	26	510	<53	<53	<53	55
1349SB21	30	370	<54	<54	<54	<54

a Hydrocarbon pattern in the sample appears as an unknown mixture atypical of fresh diesel fuel. Quantitation is based on a diesel reference from n-Cl0 through n-C24 only. Since these data do not have a specific standard, the detected amount is considered an estimate.

J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Table 4-2
SOIL SAMPLE RESULTS - METALS PRESIDIO OF SAN FRANCISCO, BUILDING 1349
(From Montgomery Watson, January 1995)

SOIL BORING	DEPTH	METALS												
		Arsenic (EPA 7060)	Beryllium (EPA 6010)	Cadmium (EPA 6010)	Chromium (EPA6OIO)	Copper (EPA 6010)	Iron (EPA 6010)	Lead (EPA 6010)	Manganese (EPA 6010)	Mercury (EPA 7471)	Nickel (EPA 6010)	Selenium (EPA 7740)	Vanadium (EPA 6010)	Zinc (EPA 6010)
	(bgs)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mglkg)	(mg/kg)	(mg/kg)	(mg/kg)	(mglkg)
1349SB01	1	2.7	0.68	<0.57	86.6	33.1	35,500	22.8	871	<0.11	74.4	<1.0	77.4	47.4
	5	4.3	0.94	<0.55	64.4	141	42,700	23.2	612	<O.II	88.2	<1.0	50.2	212
	10	4.2	0.65	<0.54	35.7	74.2	40,500	18.4	483	<0.11	81.8	<1.0	46.2	113
	13	6.1	0.54	<0.54	55	71	*38,800*	18.9	331	<0.11	104	<1.0	50.5	158
1349SB02	4	3	0.48	<0.57	110	22.8	31,600	12.3	402	<0.11	89.8	<0.50	85.5	37
	5	2.4	0.27	<0.55	91.2	15.7	*26,300*	8.6	279	<0.11	62.7	<1.0	66.7	31.3
	10	5.7	2	<0.58	45.6	84.3	*37,300*	21.2	389	<0.12	96.9	<1.0	49.3	135
1349SB03	1	3.9	<0.21	<0.51	108	26.9	20,500	34.4	409	<0.10	127	*<0.50*	41.8	74.1
	5	3	0.36	<0.56	116	17.4	31,200	14.9	808	<0.11	99	<0.50	82.5	35.4
	10	6.2	1.5	<0.57	44.3	72	37,200	21.6	196	<O.II	84.5	*<0.50*	68.5	113
	15	13.4	0.82	0.63	34.7	74.9	*47,400*	39.9	2,390	<0.11	163	<0.50	58.2	137
	20	8.1	0.56	<0.54	45.2	76.1	*47,200*	23.3	526	<O.II	125	*<0.50*	42.6	135
1349SB04	1	2.7	0.42	<0.56	120	44	*28,800*	12.3	611	<O.II	100	*<0.50*	72.5	68
	4	5.6	1.4	<0.55	45.6	146	37,100	11.6	238	<0.11	53.3	*<0.50*	47.7	191
1349SB05	1	4	0.39	<0.55	116	15.4	*32,400*	11.4	496	<O.II	74	<0.50	82.4	86.9
	5	6.4	1.2	<0.54	26.9	31.9	*26,500*	17.6	88.6	<O.II	41.3	*<0.50*	36.7	42.3
	10.8	9.7	1.8	<0.56	35	59.2	*26,000*	20.3	133	<O.II	37.7	*<0.50*	41.5	62.7
1349SB06	1	4.5 J	<0.25	<0.62	77	14.4	*26,700*	17.3	287	<0.12	42.2	<0.62	66.9	49.3
	5	3.5	0.65	<0.54	27.4	38.2	*20,000*	11.4	131	<0.11	31.7	<0.54	30.5	57.9
	10	I.I	0.35	<0.50	44.7	22.8	15,600	7.6	65.2	<0.10	27.9	<0.50	27.9	66.1
	16.5	6.4	0.72	<0.54	36.5	53.1	35,100	17.1	535	<O.II	73.8	<0.54	59.3	129
1349SB07	1	2.9	<0.23	<0.57	57.1	7.1	14,900	36.7	134	<0.11	34	<0.50	32.1	50.8
	5	2.7	1.1	<0.54	33.9	54.6	33,100	13	195	<0.11	55.2	<0.50	42.8	82.8
	10	1.8	1.6	<0.53	31.8	33.4	30,000	13.6	262	<0.11	48.8	<0.50	48	87.9
	15	5.6	0.89	<0.53	32.4	38.8	30,400	19.9	387	<0.11	65.4	<0.50	46.7	81.8
1349SB08	1	3.9	0.24	<0.61	56.4	12.5	20,100	11	377	<0.12	41.9	<0.61	50.8	37.4
	4.5	3.8	<0.23	<0.58	86.3	8.4	24,400	10.1	377	<0.12	74.6	<0.58	64.1	27.7
	10	<0.62	0.44	<0.62	113	33.1	13 ,000	17.9	17.3	0.9	55.7	<0.62	30.2	72.2
	16.5	4.6	1.4	<0.53	54.1	45.5	28,400	18	220	<0.11	46.6	<0.53	62.9	73.7
13498B09	0.5	3	0.34	<0.55	87.9	50.8	29,200	126	995	<0.11	110	<0.55	66.7	71.9
	2	3.6	0.41	<0.55	84.3	20.1	27,800	11.6	647	<0.11	60.4	<0.55	71.3	44.9
	5	3.1	0.21	<0.53	98.6	13	26,100	13.6	145	<0.11	48.8	<0.53	75.6	28.7
	10	3	0.6	<0.54	78.2	57.6	47,500	12.5	260	<0.11	43.3	<0.54	130	91.5
	15	2.4	1.9	<0.55	57.4	55	42,300	7.8	516	<0.11	69.3	<0.55	81.9	90.6
	20	10.6	1.8	<0.55	45	67.8	33,300	25.9	821	<0.11	111	<0.55	53	103
1349SB10	1	4	0.43	<0.56	92.2	23.7	31,100	12.1	1,020	<0.11	94.3 J	<0.50	75.8	61.8
	3	3	0.23	<0.55	80.1	14.1	24,600	8.2	398	<0.11	66.1	<0.50	62.1	32.8
	5	2.9	<0.22	<0.56	90.9	14	26,000	15.7	361	<0.11	67.8	<0.50	66.3	33
	6	3	0.22	<0.55	97	12.1	28,800	8.5	338	<0.11	65.3	<0.50	79:03:00	33.9
	10	7	2.1	<0.62	82.1	75.9	58,800	29.6	240	<0.12	124	<0.50	IIS	121
1349SB11	1	3.2	<0.25	<0.61	76.9	15.8	23,900	12.2	209	<0.12	39.6	<0.61	63.5	96.5
	5	4.5	1.2	<0.55	24.6	27.6	15,500	9	125	<0. II	28.2	<I.I	27.5	38.9
	9	9.3	1.4	<0.56	29.9	49.7	29,500	27	201	<0. II	40.7	<0.56	38.2	67.6
13498B12	1	4.3	0.47	<0.57	96.4	17.9	31,900	15.4	438	<0.11	65.5	<0.50	75.8	55.3
	5	4.2	1.4	<0.55	36.4	36.9	29,600	13.8	140	<0.11	42.3	<0.50	46.7	58
	10	9.5	2.3	0.58	48.2	83	44,700	23.1	330	<0.11	62.1	<0.50	52.7	74.5
	15	12.6	1.6	<0.57	40.4	87.1	47,200	33.3	465	<0.11	92.8	<0.50	61.6	139
	20	3.1	0.68	<0.59	117	55	34,100	19.5	469	<0.12	89.6	<0.50	60.2	145
1349SB13	1	2.9	<0.23	<0.58	87	12.4	23,300	10.1	301	<0.12	49.2	<1.2	66	30.8
	5	17.3	1.7	<0.61	45	73.1	46,900	26.9	193	0.95	60.6	<0.61	95	87.9
	10	8.1	1.7	<0.54	25.1	47.7	22,500	21.3	235	<0.11	38.2	<0.54	37.1	66.4

Notes:
Highlighted samples have subsequently been removed during excavation of TPH impacted soils.

TABLE 4-3
STATISTICAL SUMMARY OF SOIL RESULTS
PRESIDIO OF SAN FRANCISCO, BUILDING 1349
(From Montgomery Watson, January, 1995)

		Sample Statistics					Quartile Means[a]			
	No. of Positive Samples	Minimum	Maximum	Average	Std. Deviation	Skewness	0-25%	25-50%	50-75%	75-100%
Arsenic	50	<0.62	17.3	5.1	3	1.8	4.8	5.2	4.7	5.8
Chromium	51	24.6	120	65.7	30	OJ	70	74	72	45
Copper	51	7.1	146	44	31	1.3	52	55	30	41
Iron	51	13 ,000	58,000	31,437	9,703	0.5	35,900	31 ,685	28,123	29,925
Lead	50[b]	7.6	39.9	18	8	1	18	17	17	19
Manganese	51	17.3	2,390	414	365	3.4	551	441	438	208
Nickel	51	27.9	163	70	30	0.9	81	80	68	48
Vanadium	51	27.5	130	60	21	0.9	70	59	60	50
Zoic	51	27.7	212	80	43	1.1	86	94	62	74
TPHc	44	<1	170,000	6,976	28,130	5	<1.1	3.5	740	28,842
Ethylbenzene	15	<5	620	55	146	1.9d	<5.1	<5.3	670	1,741
Xylenes	15	<5	8,300	428	1,981	3.3d	<5.1	<5.3	95	222

Notes:

a Quartile means shown for metals are the average metal concenttations corresponding to the TPH quartiles.

b Maximum concentration detected, 126 mg/kg, was not included in the calculation as explained in the text.

C When TPH-Diesel is non-detect, TPH-Unknown is used in the calculation.

d Skewness for ethylbenzene and xylenes would be 2.8 and 5.0, respectively if ND values were included.

TABLE 4.4

GRAB GROUNDWATER SAMPLE RESULTS PRESIDIO OF SAN FRANCISCO, BUILDING 1349

(From Montgomery Watson, January 1995)

Sample ID	1349SB09	1349SB19
Depth where groundwater was encountered[a]	34 feet bgs	39.5 feet bgs
Organics (ug/l)		
TPH -Extractable	110[b] J	110,000
Benzene	<0.5	<5
Toluene	<0.5	<5
Ethylbenzene	<0.5	<5
Xylenes	<0.5	50
Metals (mg/l)		
Arsenic	<0.005	NA[c]
Beryllium	<0.002	NA
Cadmium	<0.001	NA
Chromium	1.6	NA
Copper	0.012	NA
Iron	31.1	NA
Lead	<0.0032	NA
Manganese	3.8	NA
Mercury	<0.0002	NA
Nickel	3.4	NA
Selenium	<0.005	NA
Vanadium	0.03	NA
Zinc	0.066	NA

Notes:

a Depth at which groundwater was encountered may not be the same as the groundwater table since recharge rates at the two soil borings were unknown.

b The hydrocarbon pattern of this sample represents an unknown mixture of fuel atypical of fresh diesel fuel. Quantitation is based ona diesel reference from n-Cl0 through n-24 only. Since these data do not have a specific standard, the detected amount is considered an estimate

c Not analyzed.

J - The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

TABLE 3.3
SOIL SAMPLE ANALYTICAL RESULTS - TPH.EXTRACTABLE (TPH-E)
BUILDING 1349 ASI
(From Montgomery Watson, May 1996)

Soil Boring	Depth (ft bgs)	TPH-E (mg/kg)	Soil Boring	Depth (ft bgs)	TPH-E (m/kg)
1349SB23	5	3.5	1349SB26	5	13
	10	3.3		10	3.8
	15	1.9		15	1.7
	20	<1.1		20	<1.2
	25	<1.1		25	1.3
	30	<1.1		30	1.5
	35	<1		34	<1
	40	28		40	1.8
	45	27		45	58
	50	49		50	<1.2
	58	16	1349SB28	5	7.1
1349SB24	5	93		10	<1.2
	10	<1.1		15	<1.1
	15	<1.1		20	<1.1
	20	<1.1		25	<1.1
	25	<1.1		30	<1.1
	30	<1.1		35	2.5
	35	<1.1		40	1.6
	40	<1.1		45	18
	45	<1.1		50	120
	50	4.1	1349SB29	5	3.6
1349SB25	0	6		10	1.2
	5	7.7		15	<2
	10	1.8		20	<1.2
	15	<1		25	<1.2
	20	<1.1		30	<1.1
	25	<1.1		35	<1.2
	30	<1		40	<1.2
	35	330		45	<1.1
	40	990	1349SB30	5	2.2
	45	880		10	<1.3
	50	2.5		15	1.8
				20	<1.1
				25	<1.1
				30	<1.1
				35	<1.1

Notes:
TPH-E quantified as diesel using USEPA Method 8015 Modified
ft bgs - feet below ground surface
mglkg - milligrams per kilogram

TABLE 3-5

GROUNDWATER GRAB SAMPLE ANALYTICAL RESULTS - BTEX AND TPH-E

BUILDING 1349 ASI

(From Montgomery Watson, May 1996)

Boring	Benzene (ug/L)	Toluene (ug/L)	Ethylbenzene (ug/L)	Total Xylenes (ug/L)	TPH-E (ug/L)
1349SB22	<0.5	<0.5	<0.5	<0.5	1,300
1349SB23	<0.5	<0.5	<0.5	<0.5	<50
1349SB24	<0.5	<0.5	<0.5	<0.5	<50
1349SB25	<0.5	<0.5	2.9	12	24,000
1349SB26	<0.5	<0.5	<0.5	<0.5	<50
1349SB27	<0.5	<0.5	<0.5	1.1	4.7
1349SB28	<0.5	<0.5	<0.5	<0.5	<50
1349SB29	<0.5	<0.5	<0.5	<0.5	<50
1349SB30	<0.5	<0.5	<0.5	<0.5	<50
Phase 1 Investigation (August 1993)					
1349SB09	<0.5	<0.5	<0.5	<0.5	110
Phase 2 Investigation (February 1994)					
1349SB19	<0.5	<0.5	<0.5	50	110

Notes:

BTEX - Benzene. toluene. ethylbenzene. xylenes using USEPA Method 8020
ug/L - micrograms per liter
TPH-E - Total petroleum hydrocarbons-extractable quantified as diesel u

Appendix D

Evaluation of OCP Properties and Occurrence

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engineers, scientists, economists

Appendix D. Evaluation of OCP Properties and Occurrence

As discussed in Section 2 of this Building 1349 Study Area Corrective Action Plan (CAP), organochlorine pesticides (OCPs) have been consistently detected at relatively low (and often laboratory-qualified as estimated) concentrations at one monitoring well, 1349MW100. The following subsections discuss typical uses, physical and chemical properties of OCPs, and their relation to the observed concentrations at the Study Area.

D.1 Physical and Chemical Properties and Mobility of OCPs

OCPs historically were developed to effectively control animal or insect pests and are highly toxic. The use of many OCPs in the United States has been generally discontinued since the early 1970s with the exception a few such as aldrin, dieldrin, chlordane, and endrin which were used for limited and specific use until the mid-to late-1980s. OCPs were designed to be applied to the general ground surface, either spread as a granular solid or by a liquid carrying agent, where it would remain for long periods of time. To achieve this goal, OCPs were designed to be relatively insoluble and nonvolatile, and have a strong affinity for organic carbon. Thus, OCPs have a tendency to be very stable in the environment and do not migrate in groundwater for significant distances under normal transport mechanisms.

The properties of the OCPs which directly affect their fate in the environment include:

- Water Solubility (S_w): S_w is the saturated concentration of the compound in water at a given temperature and pressure. Compounds with high S_w tend to desorb from soil and sediment, are less likely to volatilize from water, and are susceptible to biodegradation.

- Henry's Law Constant (K_H): K_H is the ratio of the partial pressure of a compound in air to the concentration of the compound in water at a given temperature under equilibrium conditions. K_H indicates the relative volatility of the constituent.

- Soil partition coefficient (K_{OC}): K_{OC} is the ratio of the adsorbed chemical per unit weight of organic carbon to the aqueous solute concentration. This indicates the tendency of a constituent to bind to particles containing organic carbon. Thus, constituents with a higher K_{OC} will also tend to move more slowly than groundwater flow as dissolved constituents will sorb onto aquifer materials. High K_{OC} of OCP constituents turns them toward sorbing to aquifer materials.

The following table summarizes the physico-chemical properties of OCPs (Montgomery Watson, 1991). The physico-chemical properties of benzene, another more mobile Study Area chemical of concern (COC), is also included for comparison.

Constituent	S_W (mg/L)	K_H (atm-m^3/mol)	K_{OC}
Alpha-BHC	1.63	5.3×10^{-6}	1,901
Beta-BHC	0.24	2.3×10^{-7}	3,573
Gamma-BHC	21.3	2.5×10^{-7}	1,901
Chlordane	0.056	4.8×10^{-5}	371,535
DDD	0.09	2.2×10^{-5}	239,883
Dieldrin	0.2	5.8×10^{-7}	35,481

Constituent	S_W (mg/L)	K_H (atm-m^3/mol)	K_{OC}
Benzene	1,780	5.5 x 10^{-3}	100

As a group, the OCP constituents exhibit very low S_W and K_H. They also have very high K_{OC}. Thus the behavior of the OCP constituents would be described by their strong preference for being sorbed to aquifer materials and by very slow and limited migration in the dissolved phase. Relatively speaking, benzene would be more preferably associated with the dissolved phase and would volatilize more readily. In the environment, OCPs would only be expected to occur in groundwater in the immediate vicinity of a source.

Another potential mechanism for OCP migration in groundwater is colloidal transport. However, prior studies completed at the Presidio indicate a general absence of OCPs sorbed to colloids or suspended solids in groundwater at the Study Area. As part of a separate study, split groundwater samples were collected from monitoring well 1349MW100. One sample was directly analyzed as collected while a duplicate was subjected to centrifugation to reduce the amount of suspended solids and colloids in the sample (BBL, 2004). The samples from well 1349MW100 were analyzed for OCPs as well as other parameters. The results of the analyses indicate that the concentrations of OCPs that were detected in the normal sample aliquot were generally marginally reduced in the centrifuged aliquot. The absence of significant reduction in concentration of OCPs in the centriguged aliquot indicates that OCPs were not sorbed to suspended solids or colloids.

D.2 Data Quality and Occurrence of OCPs at the Study Area

The following subsections discuss analytical data quality issues that may affect observed OCP data at the Study Area as well as possible scenarios for the occurrence of OCPs at the Study Area.

Analytical Data Quality Summary for OCPS at Study Area

OCPs are quantified using U.S. Environmental Protection Agency (USEPA) SW-846 Method 8081A, which is a dual-column gas chromatography method. Sample extracts are analyzed in both columns and the more conservative (i.e., higher) result from the two columns is the laboratory reported concentration. By method, a relative percent difference (RPD) of less than or equal to 40% is acceptable and the higher result is reported. The laboratory reporting limits (RLs) for OCPs are relatively low. The following summarizes cleanup levels and laboratory RLs for OCPs detected at the Study Area:

Constituent	Cleanup Level [µg/L]	Reporting Limit [µg/L]
δ-BHC	0.3	0.05
DDD	0.15	0.01
DDE	0.10	0.01
DDT	010	0.01
Aldrin	0.05	0.05
Chlordane	0.1	0.05
Dieldrin	0.5	0.05
Endrin	2	0.01
γ-BHC (Lindane)	0.2	0.05
Heptachlor	0.01	0.025

Study Area cleanup levels are discussed in Section 3.2.

It should be noted that nearly all detections of OCPs in well 1349MW100 were laboratory qualified. The majority of the laboratory qualifications were either “C”-, “J+”- or “J-”- qualified (or combinations thereof). The descriptions of commonly observed laboratory qualifications are as follows:

J – The analyte was positively identified; the associated numerical value is biased low due to a low surrogate recovery and should be considered an approximate concentration of the analyte in the sample. Data were qualified if the continuing calibration samples had two compounds with percent differences less than -15%.

J + The analyte was positively identified; the associated numerical value is biased high due to a high surrogate recovery and should be considered an approximate concentration of the analyte in the sample. Data were qualified if the continuing calibration samples had two compounds with percent differences less than +15%.

C Presence confirmed, but confirmation concentration differed by more than a factor of two.

J The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.

U The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

Of particular significance are the numerous C-qualified data observed. C-qualified data indicate that the results of the dual-column analysis varied by more than two times (100%) and, by method, the highest concentration is reported. Therefore, the lower observed column concentration was at least half of that reported. In many cases, C-qualified data had reported concentrations in excess of the appropriate cleanup levels for the Study Area. In reality, the actual concentration of a C-qualified OCP may have been lower than that reported.

Some data quality issues observed in laboratory analysis may also be related to interferences associated with high turbidity in submitted groundwater samples. As noted in Section 2, the specific yield of a majority of Study Area wells is very low. This is true at well 1349MW100. A review of field sampling logs indicates that during the seven quarterly sampling events, well 1349MW100 was dewatered during purging and sampling at least three times. On several occasions following purging, the well was left for an extended period of time to allow groundwater to recharge the well so that sufficient sample volume could be collected (Treadwell & Rollo, 2004). During the sampling events that required the well to recharge after dewatering, recharge took between approximately six hours to approximately 18 hours. In two of these cases, groundwater samples were collected the day after initial well purging began. Consequently, observed turbidity in the collected sample was sometimes relatively high (noted to be greater than >1000 NTU). Even during sampling events that took less than an hour to purge and sample, observed turbidity of samples was noted to be as high as 786 NTU.

<u>Summary of Possible Occurrence of Organochlorine Pesticides</u>

As described below, the occurrence of OCPs in Study Area monitoring well 1349MW100 is inconsistent with water quality observed in other Study Area wells. While OCPs have been detected in four other wells located generally to the west of 1349MW100, those detections were not repeatable and were laboratory qualified concentrations slightly above their detection limits. No known uses of OCPs at the Study Area were documented in previous SI reports or from general knowledge of Study Area or general Presidio activities. Presidio-wide OCP occurrences in soil and groundwater data were also evaluated, particularly for the Directorate of Engineering and Housing (DEH) Study Area (Dames & Moore, 1997; MACTEC, 2003; and Treadwell & Rollo, 2004). The DEH Study Area included a main Presidio Facility for mixing, cutting, and storing pesticides for general Presidio-wide application purposes. Relatively high concentrations of various

OCPs were detected in shallow soils (<2 feet deep) at the DEH Study Area. Despite known shallow soil sources, only one OCP, dieldrin, was detected once at a concentration of 0.04 micorgrams per liter (µg/L) at one DEH Study Area well in 1992.

In consideration of the above factors, several possible scenarios were developed for the occurrence of OCPs observed in well 1349MW100. The following summarizes some possible sources for the OCPs observed in well 1349MW100:

Possible Source of OCP at Study Area	**Discussion of Viability of Source Model**
General application of pesticides on ground surface at the Study Area.	OCPs are consistently observed at well 1349MW100. Additionally, one non-repeatable detection of an OCP in each of four wells located generally to the west of well 1349MW100 in Former Fill Site 5 (wells 1349MW101, 1349MW102, 1349MW03R and LF5GW104) have been documented (Treadwell & Rollo, 2004). If general application of OCPs in the Study Area occurred, more wide-spread and persistent detections would be expected. Therefore, this possible source is unlikely.
Undocumented "cutting" or mixing of the pesticides with diesel from the former dispenser area of the Study Area at the eastern edge of Washington Boulevard.	There were two known areas in the DEH Study Area that were used for pesticide mixing, cutting, and storage. Building 269 in the DEH Study Area was constructed for storing and mixing of pesticides used at the Presidio. Although plausible, there has been no documentation or direct evidence that mixing, cutting, or storage of pesticides occurred at the Study Area.
Elevated concentrations of OCPs in fill material used in former Area 2 and Area 3 corrective action excavations.	Fill material used for former Area 2 and Area 3 is described as controlled density fill and clean sand. Soil samples for OCP analysis have never been collected at the Study Area, including no samples of the fill material. OCPs may have been introduced from the fill material to the deeper portions of the well 1349MW100 borehole during drilling. Migration of OCPs from overlying fill material to the underlying aquifer is unlikely given physico-chemical properties.
Drilling Activities: Inadvertent introduction to the monitoring well borehole from improperly decontaminated drilling equipment.	Drilling equipment used during the advancement of the well 1349MW100 borehole may not have been effectively decontaminated prior to use. OCPs may have been introduced into the borehole from another non-Presidio site. Review of field notes from well drilling activities, however, indicate that all drilling

Possible Source of OCP at Study Area	Discussion of Viability of Source Model
	equipment and well materials were properly decontaminated. Therefore, potential cross-contamination from another site is unlikely.

Because OCPs were not considered as a potential chemical of concern for Site Investigation (SI) purposes, no associated soil samples have historically been analyzed for OCPs at the Study Area. Furthermore, as part of the excavation activities at the telecommunications conduit to remove the petroleum-impacted soil, the soil column above and in the vicinity of well 1349MW100 was removed to a maximum depth of 12 feet below ground surface (bgs) during the 1995 Army Corrective Action (IT, 1996). The excavations resulting from this 1995 Corrective Action have been subsequently been backfilled with controlled density fill and clean sand fill. Therefore, investigation in the vicinity of well 1349MW100 to determine if a current OCP soil source exists is not possible.

Although there are several potential scenarios that could explain the occurrence of OCPs at well 1349MW100, there is no clear evidence for any of them and all are based on speculation. Lacking conclusive evidence for any particular source scenario, the occurrence of OCPs at well 1349MW100 is not clearly related to any previous Building 1349 operational activities. As discussed above, potentially impacted soils in the vicinity of well 1349MW100 were excavated during the 1995 Army Corrective Action. A strategy to further evaluate the occurrence of OCPs and potential corrective actions is discussed in Sections 4 and 5 of this CAP.

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Appendix E

Occurrence of Dissolved Metals in Groundwater

Appendix E. Evaluation of Dissolved Metals Occurrence

As discussed in Section 2 of the CAP, arsenic (As), chromium (Cr), and nickel (Ni), have been detected in certain Building 1349 Study Area (Study Area) monitoring wells at concentrations that slightly exceed the respective groundwater cleanup levels for these constituents. Concentrations and distributions of these and other trace elements analyzed in groundwater samples likely reflect variations in overall hydrogeologic and geochemical conditions in the vicinity of the monitoring wells.

Localized geochemical variations and resulting variations in concentrations of metals in groundwater indicate some influence from past Study Area activities, as well as natural variability. In particular, elevated concentrations of iron and slight elevations of As in well 1349MW100 reflect the development of anoxic conditions, due to readily degradable organic compounds associated with releases of diesel or fuel oil.

Concentrations of trace elements, including As, Cr, and Ni, in groundwater result from a variety of geochemical and hydrogeologic processes and conditions. Often of fundamental importance are the concentrations of these constituents in the aquifer solids, since groundwater reactions with aquifer solids influence or ultimately determine what aqueous metal concentrations are observed. Table E-1 presents a comparison of minor and trace elemental compositions of various rock types and sediments from Presidio-wide background metals studies (EKI, 2002), with concentrations detected in soil samples collected at the Study Area. Constituent concentration data presented in Table E-1 are derived from results from soil boring samples 1349SB1 through 1349SB11. It is apparent from this table that concentrations and relative proportions of these constituents detected in soil samples near Building 1349 are comparable to background metals data from the Presidio, and are therefore unlikely to reflect enrichment from anthropogenic activities. This is further substantiated by the discussion of the nature and extent of metals observed in Study Area soils in Section 2.5.1 of the CAP. It should be noted that Presidio background metals data is only available for the four major geologic units that occur at the Presidio. Background metals characterization has not been performed for the secondary geologic units that occur at the Study Area, such as the Sheared Rock Unit and the Jurassic/Cretaceous Sedimentary Rock Unit. As such, Study Area metals data may be representative of these secondary geologic units

It is also important to consider the relative magnitude of soil and aqueous phase concentrations typically occurring in groundwater environments and in particular those detected at the Study Area. For example, average As concentrations reported for soil samples from the Study Area are approximately 5 milligrams per kilogram (mg/kg), compared to average detected aqueous As concentrations of approximately 7 micrograms per liter (µg/L). At these concentrations, assuming a porosity of 0.3 for the aquifer, there are >4,000 times more As atoms associated with solid phases compared to As atoms in solution. At lower porosities typical of unweathered fractured bedrock, there would be even more solid-phase metal atoms than in the aqueous phase. Consequently, transfer of a relatively minor amount (for example less than 0.1%) of As from the solid to aqueous phase, in response to an even a minor change in geochemical conditions (e.g. pH, temperature, Eh, ionic strength), can result in a dramatic increase in dissolved As concentrations. This phenomenon, wherein there are many orders of magnitude more solid-phase than aqueous-phase atoms and whereby slight geochemical variations can cause dramatic changes in aqueous concentrations in space and time, also applies to other metals including Fe, Cr, and Ni, in addition to As.

Concentrations of trace elements in groundwater and other near surface environments are controlled largely by reactions occurring at the surfaces of crystalline minerals and amorphous solid phases. The term "partitioning" is frequently used to describe the process by which constituents become distributed between aqueous and solid phases. Partitioning is more of a general term describing a complicated set of geochemical processes that

involve numerous variables that influence the element distributions between aqueous and solid phases. Some of the important variables include: pH; redox conditions; ionic strength; the nature and abundance of ions and neutral species that compete for different sorption sites on various solid phases; and the surface area of and the amount of sorption sites on the solid phases.

Dissolved concentrations of As detected above the cleanup level of 10 µg/L may be a concern because of the toxicity of some chemical forms of As at relatively low concentrations. As occurs primarily in groundwater as an oxyanion, either as the pentavalent (V) arsenate ion ($H_nAsO_4^{3-n}$) and/or the trivalent (III) arsenite ion ($H_nAsO_3^{3-n}$). The predominance of either arsenate or arsenite species is usually a function of the redox conditions of the aqueous environment, with arsenate dominant within aerobic, oxidizing conditions, and arsenite dominant in anaerobic, reducing conditions. Significant arsenate and arsenite concentrations may exist in either oxidizing or reducing conditions, however, possibly due to slow rates of redox transformations.

Arsenate is generally considered to be less mobile in groundwater environments, which is attributed to strong adsorption on aquifer solids, particularly iron and manganese oxyhydroxides. Although arsenite is also adsorbed on aquifer solids, it has been shown to be relatively more mobile than arsenate. The increased mobility of arsenite probably reflects a combination of its predominance over arsenate under reducing conditions, combined with less iron oxhydroxides due to reduction of iron. Arsenite's enhanced mobility is frequently of concern because it is known to be more toxic than other forms of As. However, if reducing conditions are significantly strong and sulfide ion is present, then solid phase As sulfide species may form at the low temperatures characteristic of most groundwater environments, resulting in lower aqueous As.

Figures E-1, E-2, and E-3 illustrate how sensitive the dissolved (aqueous) concentrations of a trace element like As can be to variations in important geochemical variables. Figures E-1 and E-2 describe As partitioning between solid and aqueous phases as a function of pH under oxic and reducing conditions, respectively. Figure E-3 compares how aqueous As concentrations vary with pH depending on whether oxic or reducing conditions exist within groundwater.

Figure E-1 illustrates how As partitions between the aqueous and solid phase (via sorption reactions) in an oxygenated system, while Figure E-2 applies for reducing conditions. Note that the total amount of As in the system does not change as pH varies. The total amount of As in the system is assumed to be about 1 milligrams per liter (mg/L). By comparison, at the average soil As concentration measured at the Study Area of 5 mg/kg and a porosity of about 0.3, there would be about 30 mg/L total As (solids and aqueous). This lower total As value is more appropriate for the partitioning example because all of the solid-phase As would not be available for surface exchange processes.

Identified on the X-axis of Figure E-1 are the average pH values measured for 1349MW100 (about 6.5) and 1349MW105 (about 7.4). Note that the aqueous As concentration is about 10 times higher due to the increased pH under the conditions simulated. This observation suggests that the slightly elevated dissolved As concentration at 1349MW105 may reflect influence from the relatively high pH at this location, although variations in other geochemical concentrations and conditions undoubtedly influence it as well. Factors contributing to the As concentrations reported, in addition to pH, may include: solid-phase As concentrations; sorption characteristics of the solid phases (surface area, type, and concentrations of surface-exchange sites); ionic strength; type and concentrations of other aqueous phases, which may compete with As for sorption sites; redox conditions; temperature; and of course, uncertainties associated with field sampling and laboratory analytical methods.

Figure E-3 presents a comparison of predicted dissolved As concentrations versus pH for oxic and reducing conditions. It is clear from this Figure that reducing conditions result in enhanced concentrations of dissolved

As throughout the entire pH range considered as compared with oxic conditions. Such geochemical behavior is consistent with the slightly elevated As concentrations observed repeatedly at 1349MW100. Reducing conditions near this location are indicated by:

1) the high dissolved iron concentrations (from 10 to more than 100 times higher than adjacent wells); and
2) low sulfate concentration, indicative of sulfate reduction, which occurs only after complete elimination of dissolved oxygen.

Enhanced aqueous iron concentrations favor desorption of As and higher aqueous As concentrations, due to a combination of: lower solid Fe oxides/hydroxides; preferential sorption of dissolved ferrous iron compared to As; and the observation that reduced As (arsenite) adsorbs less strongly than arsenate. Furthermore, field and laboratory studies have indicated that elevated alkalinity promotes higher aqueous As concentrations, due to preferential sorption of carbonate ions. Elevated alkalinity, which is typically a product of sulfate reduction, is apparent in the data for 1349MW100.

Although Figure E-3 illustrates that aqueous As concentrations may be enhanced in groundwater under reducing compared to oxic conditions, Figure E-2 shows how proportionally more As still adsorbs to solid phases compared to As in solution (except at pH>10). Such behavior has important implications for the fate and transport of As in groundwater because adsorption processes retard As migration in groundwater and serve to reduce aqueous As concentrations at downgradient locations.

As geochemistry is discussed in detail because the highest As concentrations are detected slightly in excess of the groundwater cleanup level at monitoring well 1349MW105, located proximate to petroleum hydrocarbon impacts associated with Building 1349. Most of the processes and types of geochemical reactions that influence As geochemistry and the distribution and concentration of As in groundwater discussed above apply for the other metals of concern at the Study Area, including Ni and Cr. Applicability of As geochemistry to metals like Ni and Cr arises from the fact that the same ***types*** of geochemical reactions and processes influence their groundwater concentrations, although specifics of the reactions may differ. It is true that groundwater Cr concentrations may differ in response to redox conditions and that Cr behavior may appear to be opposite that of As. However, groundwater Cr (and Ni) concentrations will still result from:

1) hydrogeochemical processes occurring between aqueous and solid phases, that are controlled largely by
2) surface chemical reactions, which vary greatly depending on specific and general geochemical conditions. Surface partitioning reactions in turn are dependent upon
3) the "natural", and if applicable, anthropogenic-influenced composition of solid phases and/or hydraulically upgradient groundwater.

All in all, the variation in aqueous concentrations of these metals from one well to another is to be expected given the range of variability in individual constituent concentrations and overall geochemical conditions. In fact, it is probably more remarkable that the concentrations do not show greater variation, considering the numerous variables that effect the concentrations and distributions of these elements.

Geochemical properties of elements like As and trace metals such as Ni and Cr contribute to the fate and transport of constituents in groundwater. It is important to consider how the geochemical behavior influences the migration and concentrations of constituents from source areas of impacted groundwater.

To evaluate potential migration of As from the Study Area, specifically the area of well 1349MW100, solute transport modeling was performed using WinTran©, an analytical elemental groundwater modeling program

(ESI, 1995). For the model simulations, it was assumed that a constant source of As, with a concentration of 20 µg/L, exists at 1349MW100. This assumed source concentration is greater than the average value of approximately 13 ug/L detected in groundwater samples collected historically from this well. Groundwater was assumed to migrate toward 1349MW03R, which is located approximately 150 feet hydraulically downgradient. A hydraulic gradient of approximately 0.0067 was assumed, which is based on hydraulic head data provided in Figure 2-3.

A horizontal hydraulic conductivity (Kh) value of 4.4 feet per day (ft/d) was assumed in the model. This corresponds to the highest Kh estimated from specific capacity data collected during purging of monitoring wells, despite an estimated Kh of approximately 0.7 ft/d apparent for 1349MW100. The highest Kh value was applied to develop a likely worst-case modeling scenario with respect to groundwater migration. Longitudinal and tranverse dispersivity values of 10 feet and 1 foot, respectively, are assumed.

The model input applicable to the geochemical behavior of As is represented by the retardation factor, which is defined as follows:

$$Rf = 1 + r_b/\theta * Kd$$

Where:

Rf = retardation factor
r_b = bulk density
θ = porosity
Kd = partition coefficient.

The partition coefficient (Kd) is defined as the ratio of the solid As concentration to the aqueous As concentration. For this analysis, it was derived from the solid-aqueous partitioning data presented in Figure E-2, which applies to As behavior under reducing conditions. This approach is conservative in that it assumes As exists, and remains in, its relatively more mobile trivalent state. Values of Kd presented in Figure E-2 will vary as a function of pH, which at the Study Area is reported to range between about 5.6 and 8.2.

Two values for porosity were considered, which represent likely end-members considering groundwater conditions in the area. A high porosity of 0.3 would correspond to weathered materials occurring near the water table and a lower porosity of 0.01 would correspond to values typical of fractured bedrock. A grain density of 2.55, applicable to the mineral serpentine, was assumed in order to calculate the respective bulk densities at the assumed porosity values.

Rfs, estimated from the conditions described above and the data presented in Figure E-2, range between a low of 21 for a porosity of 0.01 at pH = 5.5 to a high of 54 for a porosity of 0.3 at pH = 7.5 and 8.0. Consistent with the worst-case scenario approach, the lowest value of 21 was applied in the model.

Figures E-4 and E-5 present results of the solute transport modeling for As under the conditions described. Figure E-4 applies to the high porosity simulation and Figure E-5 applies to the low porosity simulation. The Figures present the model-predicted As concentrations versus time at a location 150 feet hydraulically downgradient of monitoring well 1349MW100. Results indicate that a maximum As concentration of about 3.5 mg/L would occur after about 9 to10 years for the low-porosity simulation and about 3.8 mg/L would occur after about 175 years for the high porosity situation. These results illustrate how even under the worst-case conditions assumed herein, significant attenuation of As concentrations is expected occur, resulting in concentrations below the target cleanup values.

TABLE E-1

SOIL SAMPLE RESULTS - METALS PRESIDIO OF SAN FRANCISCO, BUILDING 1349 STUDY AREA*
COMPARISON WITH PRESIDIO-WIDE BACKGROUND DATA**

Element	**Building 1349 Study Area***			**Range of Detected Metals in Presidio Geologic Materials****			
	Average	Maximum	Minimum	*Serpentinite*	*Colma Formation*	*Beach/Dune Sand*	*Chert/Shale*
Fe	31,800	58,800	14,900	32,300 - 120,000	7,650-3,800	6,030-34,900	420-46,000
Mn	414	2,390	17	12,000-270,000	2,430-6,500	1,520-10,500	4270***
Zn	80	212	28	17-114	15.5-61.6	7.45-74.3	2.6-140
Ni	70	163	28	686-3,950	31.2-123	15-82.9	4-110
Cu	45	146	7	11.1-64.6	3.02-80.8	3.11-57.2	3.1-310
As	5.2	17.3	1.8	0.32-4.09	1.49-5	1.11-5.96	2.46-3.2
Cr	66	120	25	493-1,680	24-149	17.9-142	1.1-48.4

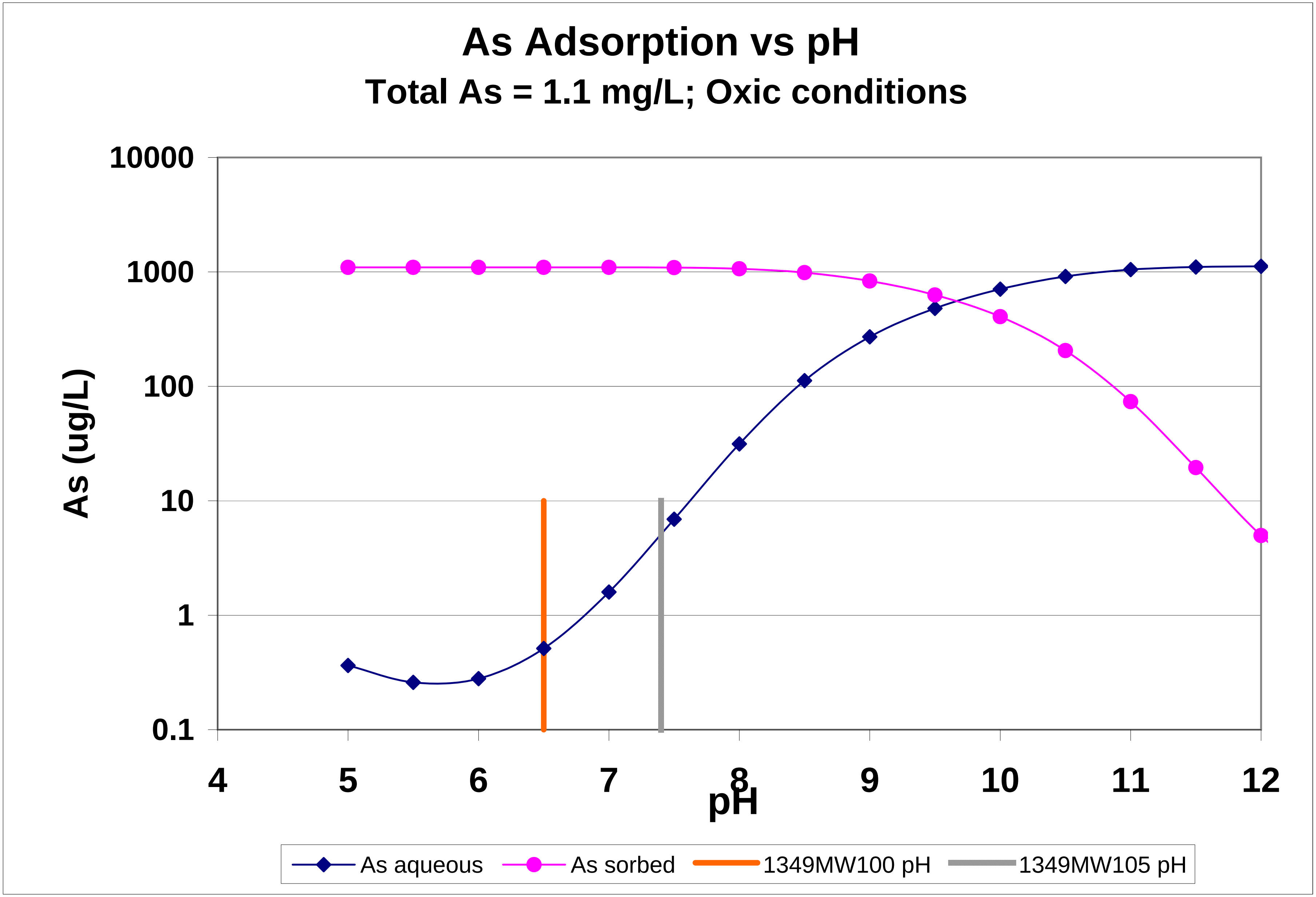
values in mg/Kg

* Results for soil borings 1349SB1 through 1349SB11

**Data reported in Cleanup Levels Document, Tables C-1 through C-4 (EKI, 2002)

*** Only one sample in background data set was analyzed for Mn.

FIGURE E-1



As Adsorption vs pH
Total As = 1.1 mg/L; Oxic conditions
As (ug/L)
10000
1000
100
10
1
0.1
4
5
6
7
8
9
10
11
12
pH
As aqueous
As sorbed
1349MW100 pH
1349MW105 pH

Figure E-2

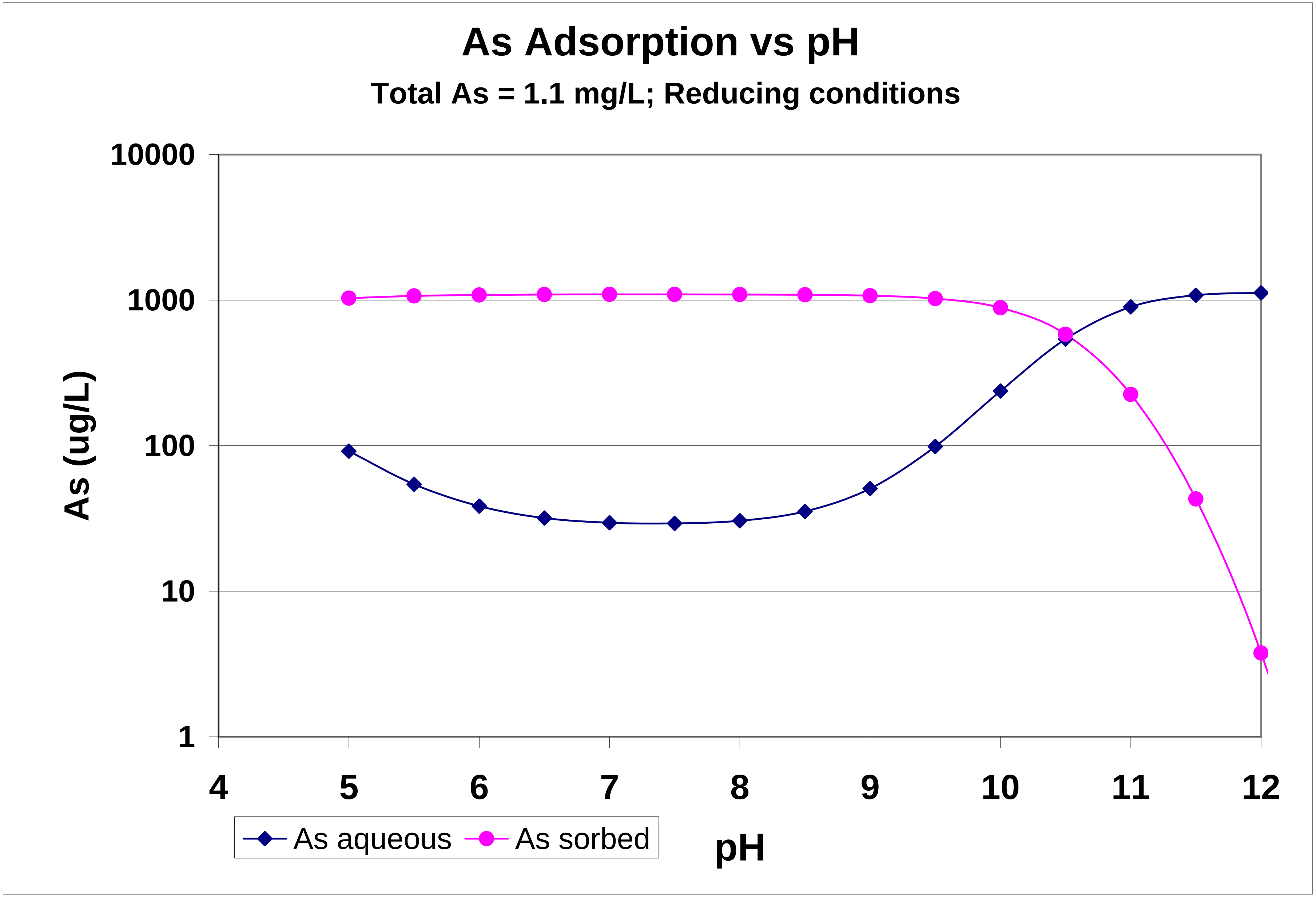
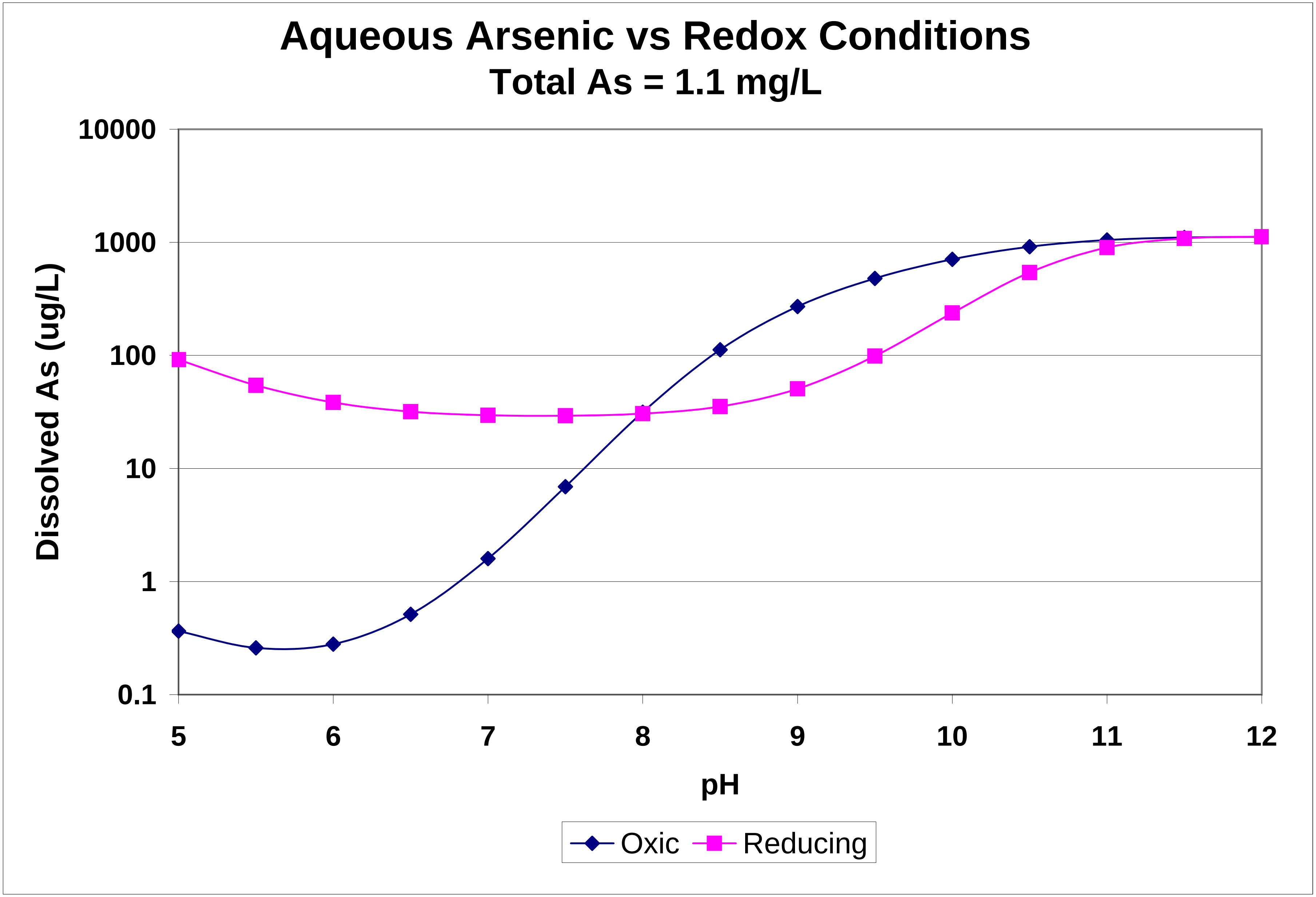

As Adsorption vs pH
Total As = 1.1 mg/L; Reducing conditions
As (ug/L)
10000
1000
100
10
1
4
5
6
7
8
9
10
11
12
pH
As aqueous
As sorbed

FIGURE E-3



Aqueous Arsenic vs Redox Conditions
Total As = 1.1 mg/L
10000
1000
100
10
1
0.1
Dissolved As (ug/L)
5
6
7
8
9
10
11
12
pH
Oxic
Reducing

Figure E-4

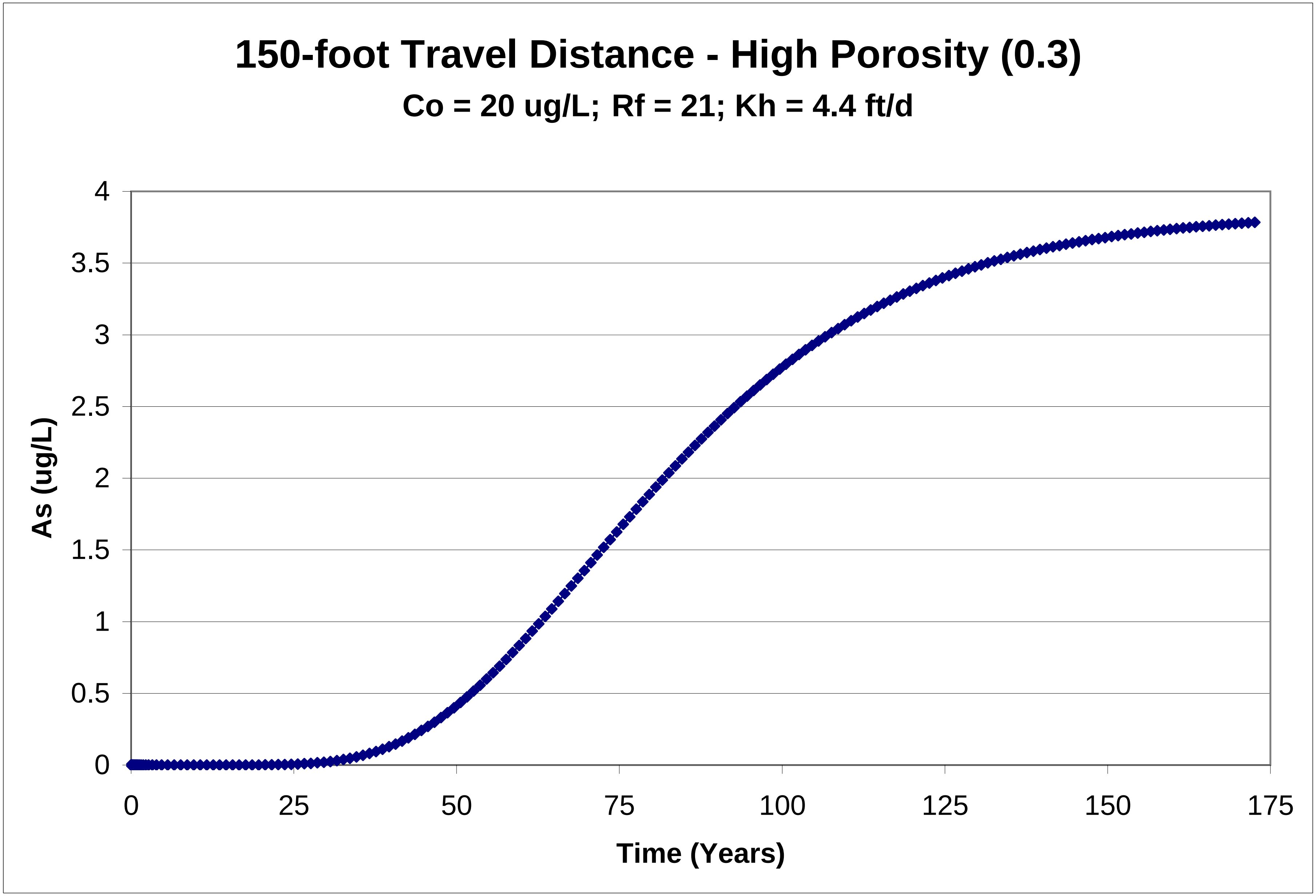
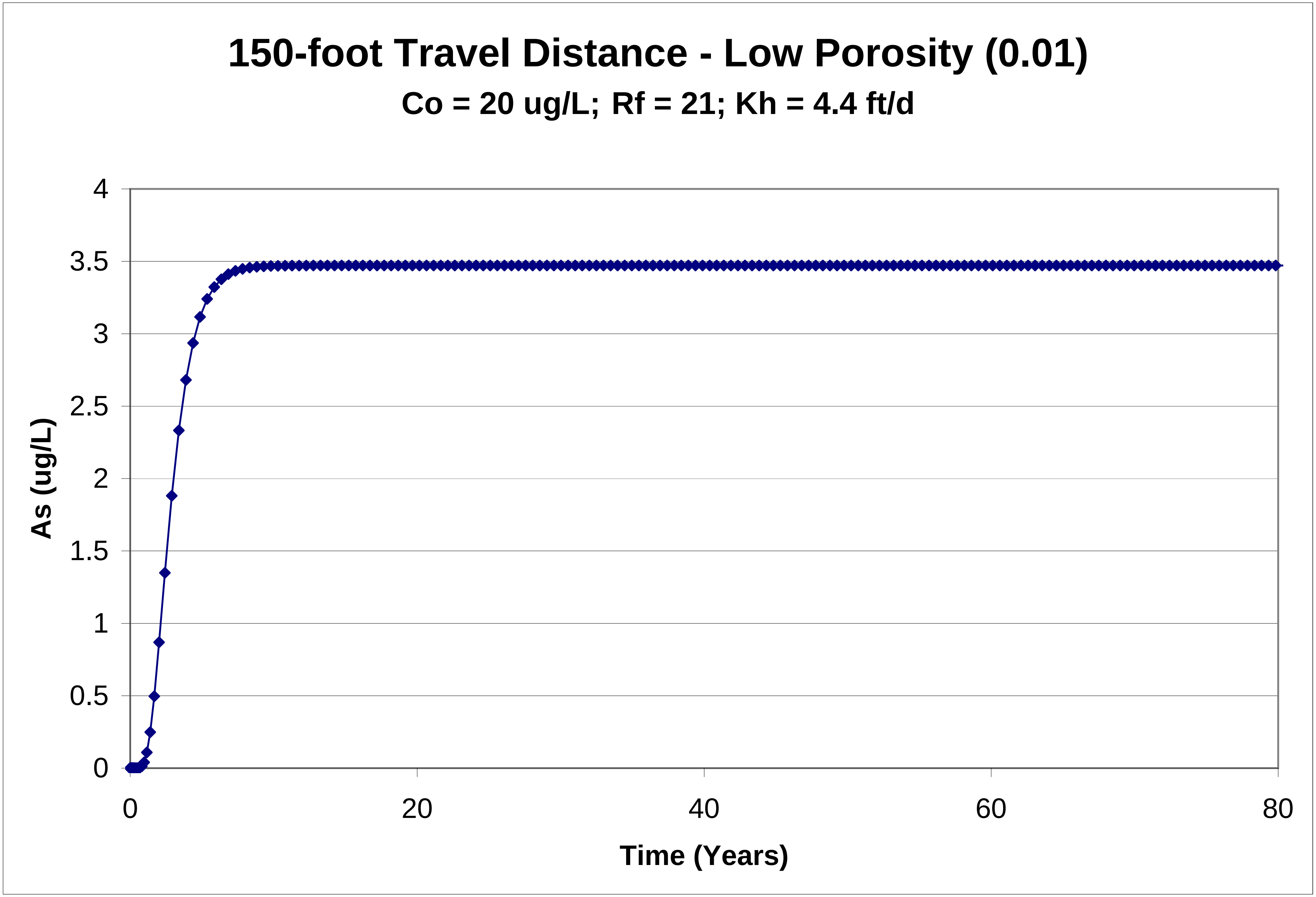

150-foot Travel Distance - High Porosity (0.3)
Co = 20 ug/L; Rf = 21; Kh = 4.4 ft/d
As (ug/L)
0
0.5
1
1.5
2
2.5
3
3.5
4
0
25
50
75
100
125
150
175
Time (Years)

Figure E-5



150-foot Travel Distance - Low Porosity (0.01)
Co = 20 ug/L; Rf = 21; Kh = 4.4 ft/d
As (ug/L)
4
3.5
3
2.5
2
1.5
1
0.5
0
0
20
40
60
80
Time (Years)

Appendix F

Cost Estimates and Assumptions for Corrective Action Alternatives

Table F-1
Summary of Estimated Costs for Corrective Action
Building 1349 Study Area
Presidio of San Francisco, California

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Remedial Unit	Alternative	Total Estimated Costs	Estimated Capital Costs	Estimated Annual Costs
Shallow Soil RU				
	No Action (Table F-2a)	$6,000.00	$6,000.00	-
	Excavation and Offsite Disposal (Table F-2b)	$399,647.00	$399,647.00	-
	Capping (Table F-2c)	$501,197.00	$251,956.00	$249,241.00
	Land-Use Controls (Table F-2d)	$79,845.00	$10,187.00	$69,658.00
Deep Soil RU				
	No Action (Table F-2a)	$6,000.00	$6,000.00	-
	Excavation and Offsite Disposal (Table F-3a)	$193,994.00	$193,994.00	-
	Subsurface Capping (Table F-3b)	$327,107.00	$180,556.00	$146,551.00
Telecommunications Corridor Soil RU				
	No Action (Table F-2a)	$6,000.00	$6,000.00	-
	Capping (Table F-4a)	$556,727.00	$307,486.00	$249,241.00
	Excavation and Offsite Disposal (Table F-4b)	$419,343.00	$419,343.00	-
	Land-Use Controls (Table F-2d)	$79,845.00	$10,187.00	$69,658.00
Groundwater RU				
	No Action (Table F-5a)	$37,542.00	$37,542.00	-
	Groundwater Monitoring (Table F-5b)	$574,588.00	$65,728.00	$508,860.00
	Land-Use Controls (Table F-5c)	$79,845.00	$10,187.00	$69,658.00
All Soil RUs	Excavation and Offsite Disposal (Table F-7)	$654,953.00	$654,953.00	-
Implementation of Preferred Alternatives	**Excavation and Offsite Disposal (Table F-7) + Groundwater Monitoring (Table F-5b)**	**$1,229,541.00**	**$720,681.00**	**$508,860.00**

Notes:

1. Individual alternatives may have some redundant costs depending on selected remedy, such as mobilization and Remediation Completion Report.

Table F-2a
Soil Remedial Units
Estimated Costs Associates with No Action
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Unit	Quantity	Unit Cost	Subtotal	Total
	Estimated Costs				
Capital Costs					
General Administrative Costs	ls	1	$5,000	$5,000	
					$5,000
Subtotal Estimated Costs (w/contractor overhead and profit):					$5,000
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					-
Subtotal Estimated Costs (w/legal and administrative costs):					$5,000
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$1,000
Total Preliminary Estimated Capital Costs of Remedial Alternative:					**$6,000**

Notes
1. Totals may not sum exactly because of rounding.
2. Derivation of unit rates is presented in Table F-6.

Table F-2b
Shallow Soil Remedial Unit
Estimated Costs Associated with Soil Excavation and Offsite Disposal
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Unit	Quantity	Unit Cost	Subtotal	Total
	Estimated Costs				
Capital Costs					
General Site Preparation					
Mobilize Contractor Equipment and Supplies to Site	ls	1	$23,400	$23,400	
Erect and Maintain Perimeter Temporary Fence	ft	1000	$12.00	$12,000	
Decontamination Area for Personnel and Equipment	ls	1	$1,500	$1,500	
					$36,900
Abandon Well 1349MW103					
Abandon 2-inch PVC Monitoring Wells	ea	1	$1,755	$1,755	
Dispose of Well Abandonment Residuals	ea	1	$500	$500	
Install Replacement Well 1349MW103R					
Mobilize contractor equipment and supplies to site	ls	1	$300	$300	
Drill and install groundwater monitoring well	ft	45	$38	$1,710	
Engineer to install the groundwater well	day	1	$1,170	$1,170	
Conduct Groundwater Monitoring (replacement well)					
Sample Well	ea	1	$263	$263	
Dispose of Groundwater Sampling Residuals	event	1	$500	$500	
Analyze Groundwater Samples from Wells					
General Water Quality Parameters	ea	1	$205	$205	
Volatile Organic Compounds (USEPA Method 8260B)	ea	1	$250	$250	
Polycyclic Aromatic Hydrocarbons (USEPA Method 8270C)	ea	1	$250	$250	
Organochlorine Pesticides (USEPA Method 8081)	ea	1	$165	$165	
Total Petroleum Hydrocarbons as Gasoline, as Diesel Fuel, and as Motor Oil (USEPA 8015 + USEPA 3630A, silica gel cleanup)	ea	1	$140	$140	
Metals (USEPA Method 6010/7000)	ea	1	$225	$225	
Perform Independent Data Validation	ea	1	$41	$41	
Input Analytical Results into Presidio Database	ea	1	$18	$18	
					$7,492
Excavate Waste and Soil					
Excavate Soil, No Segregation	cy	780	$4.10	$3,198	
Collect Soil Profile Samples for Disposal (every 500 cy)	ea	2	$30	$61	
Disposal Characterization					
PAHs by USEPA Method 8081/8082	ea	2	$250	$500	
Total Petroleum Hydrocarbons as Diesel Fuel, Fuel Oil, and Gasoline (USEPA 8015M + USEPA 3630A, silica gel cleanup)	ea	2	$140	$280	
Backfill Exavation	cy	1014	$23.00	$23,322	
Dispose of Nonhazardous Soil at Class II Facility	ton	1622	$35	$56,784	
					$84,145
Restoration Activities					
Replant in Historic Forest Zone	acre	0.1	$58,000	$5,800	
					$5,800

Table F-2b
Shallow Soil Remedial Unit
Estimated Costs Associated with Soil Excavation and Offsite Disposal
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Estimated Costs				
	Unit	Quantity	Unit Cost	Subtotal	Total
Design and Construction Management Services					
Engineering					
Perform General Planning Activities	ls	1	$23,400	$23,400	
Prepare Well Abandonment Letter Report	ls	1	$5,000	$5,000	
Prepare Remedial Design (plans and specifications)	sheet	6	$7,500	$45,000	
Bid, Award, and Negotiate Construction Contract	ls	1	$29,250	$29,250	
					$102,650
Construction Observation					
Provide Resident Engineer	wk	2	$5,850	$11,700	
Provide Office Support	wk	2	$2,340	$4,680	
Provide Vehicles and Equipment	wk	2	$1,521	$3,042	
Perform Air Monitoring	wk	2	$1,170	$2,340	
Collect Soil Confirmation Samples	ea	31	$30	$930	
PAHs by USEPA Method 8081/8082	ea	31	$250	$7,750	
Total Petroleum Hydrocarbons as Diesel Fuel, Fuel Oil, and Gasoline (USEPA 8015M + USEPA 3630A, silica gel cleanup)	ea	31	$140	$4,340	
OCPs (USEPA 8081)	ea	9	$165	$1,485	
Perform Independent Data Validation	ea	31	$41	$1,271	
Input Analytical Results into Presidio Database	ea	31	$18	$558	
Prepare Remediation Completion Report	ls	1	$27,000	$27,000	
					$65,096
Engineering Project Management					
9% of Design and Excavation Management Services	ls	9%			$15,097.14
Subtotal Estimated Costs (w/contractor overhead and profit):					$317,180
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$15,859
Subtotal Estimated Costs (w/legal and administrative costs):					$333,039
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$66,608
Total Preliminary Estimated Capital Costs of Remedial Alternatives:					**$399,647**

Notes and Assumptions:

1. Totals may not sum exactly because of rounding.
2. Field effort of excavation and well abandonment is estimated to be 2 weeks in duration.
3. Sidewall confirmation samples will be collected at an approximate frequency of one sample per every 50 linear feet or one sample per sidewall (assuming four sidewalls) for a total of 13 samples (plus 1 duplicate). Samples will be analyzed for TPHd, TPHfo, TPHg, (USEPA 8015M), and PAHs (USEPA 8270). All samples for TPH analysis will be prepared with a silica gel cleanup (SGCU).
4. Bottom confirmation samples will be collected at a frequency of one sample per 625 sf for a total of 5 samples. Samples will be analyzed for the same parameters as sidewall samples.
5. Assumes that sidewall and bottom samples will be collected for OCP analysis from Shallow Soil Area #3 which is in the vicinity of well 1349MW100 where OCPs have been detected in groundwater.
6. Waste characterization samples will be collected approximately one per 500 cy. Samples will be analyzed for TPH and PAHs.
7. Assumes that well 1349MW103 will be abandoned prior to excavation and reinstalled after backfilling. Well 1349MW103 will be sampled before abandonement (during regulary scheduled monitoring event) and after reinstallation.
8. Volumes are provided in Table 5-1.
9. Conversion factor from cy of soil to tons is 1.6.
10. Soil volume is in-situ estimation. Backfill is estimated as 1.3 compaction factor.
11. Derivation of the unit rates is presented in Table F-6.

Table F-2c
Shallow Soil Remedial Unit
Estimated Costs Associated with Capping
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Unit	Quantity	Unit Cost	Subtotal	Total
	Estimated Costs				
Capital Costs					
General Site Preparation					
Mobilize contractor equipment and supplies to site	ls	1	$23,400	$23,400.00	
Erect and maintain perimeter temporary fencing	ft	1,000	$12.00	$12,000.00	
Set up decontamination area for personnel and equipment	ls	1	$1,500	$1,500.00	
					$36,900.00
Construct Cap					
Excavate and stockpile top foot of surface soil	cy	93	$4.10	$381.30	
Collect soil profile samples for disposal or reuse	ea	1	$30.00	$30.00	
TPHg, TPHd, MO	ea	1	$140.00	$140.00	
PAHs	ea	1	$250.00	$250.00	
Furnish and install geosynthentic liner	sf	2500	$1.00	$2,500.00	
Import and Place Clean Topsoil (12 inches)	cy	121	$35	$4,235.00	
Grade Area	day	1	$2,000	$2,000.00	
Replant in Historic Forest Zone	acre	0.1	$58,000	$5,800.00	
					$15,336.30
Design and Construction Management Services					
Engineering					
Perform general planning activities	ls	1	$23,400	$23,400.00	
Prepare remedial design (plans and specifications)	sheet	6	$7,500	$45,000.00	
Bid, award, and negotiate construction contract	ls	1	$29,250	$29,250.00	
Construction Observation					
Provide resident engineer	wk	1	$5,850	$5,850.00	
Provide office support	wk	1	$2,340	$2,340.00	
Provide vehicles and equipment	wk	1	$1,521	$1,521.00	
Perform air monitoring	wk	1	$1,170	$1,170.00	
Prepare Remediation Completion Report	ls	1	$27,000	$27,000.00	
					$135,531.00
Engineering Project Management					
9% of Design and Construction Management Services					$12,197.79
Subtotal Estimated Costs (w/contractor overhead and profit):					$199,965
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$9,998
Subtotal Estimated Costs (w/legal and administrative costs):					$209,963
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$41,993
Total Preliminary Estimated Capital Costs of Remedial Alternatives:					**$251,956**
Annual Costs					
Perform topographic survey to monitor settling every 5 years	day	1	$161.00	$161.00	
Conduct 5 year review of remedy performance	ls		$5,850.00	$5,850.00	
Repair damage to cover	ls		$4,212.00	$4,212.00	
Annualized costs ($10,223) over 30 years assume discount rate of 3.1%				$10,223.00	$197,810.00
Subtotal Estimated Costs (w/contractor overhead and profit):					$197,810
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$9,891
Subtotal Estimated Costs (w/legal and administrative costs):					$207,701
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$41,540
Total Preliminary Estimated Annual Costs of Remedial Alternatives:					**$249,241**
Total Preliminary Estimated Costs of Remedial Alternatives:					**$501,197**

Notes
1. Totals may not sum exactly because of rounding.
2. Field effort for cap contruction assumes 1 week.
3. Costs for groundwater monitoring are included in the Groundwater RU Costs.
4. Derivation of unit rates is presented in Table F-6.

Table F-2d
Shallow Soil and Telecommunication Corridor Soil Remedial Units
Estimated Costs Associated with Land-Use Controls
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Estimated Costs				
	Unit	Quantity	Unit Cost	Subtotal	Total
Capital Costs					
Allocated share to prepare LUC Master Reference Report	ls	1	$2,500.00	$2,500.00	
Prepare Site-Specific Addendum to the Land-Use Control Master Reference Report (Area B)	ls	1	$5,000.00	$5,000	
Add Site-Specific Land-Use Controls to Trust GIS System	ls	1	$585.00	$585	
					$8,085
Subtotal Estimated Costs (w/contractor overhead and profit):					$8,085
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$404
Subtotal Estimated Costs (w/legal and administrative costs):					$8,489
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$1,698
Total Preliminary Estimated Capital Costs of Remedial Alternatives:					**$10,187**
Annual Costs					
Project Management/Administration					
Annual Administrative Cost of Land-Use Controls (Area B)	ls	30	$1,000.00	$1,000	
Five-Year Review (annualized $2,000 over 30 years)	ls	30	$2,000.00	$2,000	
Annual costs annualized over 30 years, assumes discount rate of 3.1%					$58,048
Subtotal Estimated Costs (w/contractor overhead and profit):					$58,048
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					-
Subtotal Estimated Costs (w/legal and administrative costs):					$58,048
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$11,610
Total Preliminary Estimated Annual Costs of Remedial Alternatives:					**$69,658**
Total Preliminary Estimated Costs of Remedial Alternatives:					**$79,845**

Notes
1. Totals may not sum exactly because of rounding.
2. Costs for groundwater monitoring are included in the Groundwater RU Costs.
3. Derivation of unit rates is presented in Table F-6.

Table F-3a **DRAFT**
Deep Soil Remedial Unit
Estimated Costs Associated with Soil Excavation and Offsite Disposal
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Unit	Quantity	Unit Cost	Subtotal	Total
	Estimated Costs				
Capital Costs					
General Site Preparation					
Included in Shallow Soil Remedy					
					$0
Excavate Waste and Soil					
Excavate Soil, No Segregation	cy	30	$4.10	$123	
Collect Soil Profile Samples for Disposal (every 500 cy)	ea	1	$30	$30	
Disposal Characterization					
PAHs by USEPA Method 8081/8082	ea	1	$250	$250	
Total Petroleum Hydrocarbons as Diesel Fuel, Fuel Oil, and Gasoline (USEPA 8015M + USEPA 3630A, silica gel cleanup)	ea	1	$140	$140	
Backfill Exavation	cy	39	$23.00	$897	
Dispose of Nonhazardous Soil at Class II Facility	ton	62	$35	$2,184	
					$3,624
Design and Construction Management Services					
Engineering					
Perform General Planning Activities	ls	1	$23,400	$23,400	
Prepare Remedial Design (plans and specifications)	ls	6	$7,500	$45,000	
Bid, Award, and Negotiate Construction Contract	ls	1	$29,250	$29,250	
					$97,650
Construction Observation					
Provide Resident Engineer	wk	1	$5,850	$5,850	
Provide Office Support	wk	1	$2,340	$2,340	
Provide Vehicles and Equipment	wk	1	$1,521	$1,521	
Perform Air Monitoring	wk	1	$1,170	$1,170	
Collect Soil Confirmation Samples	ea	5	$30	$150	
PAHs by USEPA Method 8081/8082	ea	5	$250	$1,250	
Total Petroleum Hydrocarbons as Diesel Fuel, Fuel Oil, and Gasoline (USEPA 8015M + USEPA 3630A, silica gel cleanup)	ea	5	$140	$700	
Perform Independent Data Validation	ea	5	$41	$205	
Input Analytical Results into Presidio Database	ea	5	$18	$90	
Prepare Remediation Completion Report	ls	1	$27,000	$27,000	
					$40,276
Engineering Project Management					
9% of Design and Excavation Management Services	ls	9%			$12,413.34
Subtotal Estimated Costs (w/contractor overhead and profit):					$153,964
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$7,698
Subtotal Estimated Costs (w/legal and administrative costs):					$161,662
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$32,332
Total Preliminary Estimated Capital Costs of Remedial Alternatives:					**$193,994**

Table F-3a
Deep Soil Remedial Unit
Estimated Costs Associated with Soil Excavation and Offsite Disposal
Building 1349 Study Area
Presidio of San Francisco, California

Notes and Assumptions:

1. Totals may not sum exactly because of rounding.
2. Field effort of excavation is estimated to be 1 week in duration.
3. Sidewall confirmation samples will be collected at an approximate frequency of one sample per every 50 linear feet or one sample per sidewall (assuming 4 sidewalls) fo a total of 4 samples (plus 1 duplicate). Samples will be analyzed for TPHd, TPHfo, TPHg, (USEPA 8015M), and PAHs (USEPA 8270). All samples for TPH analysis will be prepared with a silica gel cleanup (SGCU).
4. Bottom confirmation samples will be collected at a frequency of one sample per 625 sf for a total of 1 sample. Samples will be analyzed for the same parameters as sidewall samples.
5. Waste characterization samples will be collected approximately one per 500 cy. Samples will be analyzed for TPH and PAHs.
6. Volumes are provided in Table 5-1.
7. Conversion factor from cy of soil to tons is 1.6.
8. Soil volume is in-situ estimation. Backfill is estimated as 1.3 compaction factor.
9. Cost estimate assumes Shallow Soil RU remedy is excavation and offsite disposal.
10. Assumes well 1349MW103 will be abandoned and replaced in shallow RU remedy.
10. Derivation of the unit rates is presented in Table F-6.

Table F-3b
Deep Soil Remedial Unit
Estimated Costs Associated with Subsurface Capping
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Unit	Quantity	Unit Cost	Subtotal	Total
	Estimated Costs				
Capital Costs					
General Site Preparation					
Included in Shallow Soil Remedy					$0.00
Construct Cap					
Furnish and install geosynthetic liner	sf	100	$1.00	$1,500.00	
					$1,500.00
Design and Construction Management Services					
Engineering					
Perform general planning activities	ls	1	$23,400	$23,400.00	
Prepare remedial design (plans and specifications)	sheet	6	$7,500	$45,000.00	
Bid, award, and negotiate construction contract	ls	1	$29,250	$29,250.00	
Construction Observation					
Provide resident engineer	wk	0.5	$5,850	$2,925.00	
Provide office support	wk	0.5	$2,340	$1,170.00	
Provide vehicles and equipment	wk	0.5	$1,521	$760.50	
Perform air monitoring	wk	0.5	$1,170	$585.00	
Prepare Remediation Completion Report	ls	1	$27,000	$27,000.00	
					$130,090.50
Engineering Project Management					
9% of Design and Construction Management Services					$11,708.15
Subtotal Estimated Costs (w/contractor overhead and profit):					$143,299
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$7,165
Subtotal Estimated Costs (w/legal and administrative costs):					$150,464
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$30,093
Total Preliminary Estimated Capital Costs of Remedial Alternatives:					**$180,556**
Annual Cost					
Perform topographic survey to monitor settling every 5 years	day	1	$161.00	$161.00	
Conduct 5 year review of remedy performance	ls		$5,850.00	$5,850.00	
Annualized costs ($6011) over 30 years assume discount rate of 3.1%				$6,011.00	$116,310.00
Subtotal Estimated Costs (w/contractor overhead and profit):					$116,310
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$5,816
Subtotal Estimated Costs (w/legal and administrative costs):					$122,126
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$24,425
Total Preliminary Estimated Annual Costs of Remedial Alternatives:					**$146,551**
Total Preliminary Estimated Costs of Remedial Alternatives:					**$327,107**

Notes

1. Totals may not sum exactly because of rounding.
2. Field effort for cap construction is estimated to be 1 week in duration.
3. Costs for groundwater monitoring are included in the Groundwater RU Costs.
4. Assumes shallow soil RU remedy is excavation and offsite disposal.
5. Derivation of unit rates is presented in Table F-6.

Table F-4a **DRAFT**
Telecommunications Corridor Soil Remedial Unit
Estimated Costs Associated with Capping
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Estimated Costs				
	Unit	**Quantity**	**Unit Cost**	**Subtotal**	**Total**
Capital Costs					
General Site Preparation					
Mobilize contractor equipment and supplies to site	ls	1	$23,400	$23,400.00	
Erect and maintain perimeter temporary fencing	ft	1,000	$12.00	$12,000.00	
Set up decontamination area for personnel and equipment	ls	1	$1,500	$1,500.00	
					$36,900.00
Construct Cap					
Excavate and stockpile top foot of surface soil	cy	380	$4.10	$1,558.00	
Collect soil profile samples for disposal or reuse	ea	1	$30.00	$30.00	
TPHg, TPHd, MO	ea	1	$140.00	$140.00	
PAHs	ea	1	$250.00	$250.00	
Furnish and install geosynthentic liner	sf	700	$1.00	$1,500.00	
Import and Place Clean Topsoil (12 inches)	cy	494	$35	$17,290.00	
Replant in Historic Forest Zone	acre	0.03	$58,000	$1,740.00	
					$59,408.00
Design and Construction Management Services					
Engineering					
Perform general planning activities	ls	1	$23,400	$23,400.00	
Prepare remedial design (plans and specifications)	sheet	6	$7,500	$45,000.00	
Bid, award, and negotiate construction contract	ls	1	$29,250	$29,250.00	
Construction Observation					
Provide resident engineer	wk	1	$5,850	$5,850.00	
Provide office support	wk	1	$2,340	$2,340.00	
Provide vehicles and equipment	wk	1	$1,521	$1,521.00	
Perform air monitoring	wk	1	$1,170	$1,170.00	
Prepare Remediation Completion Report	ls	1	$27,000	$27,000.00	
					$135,531.00
Engineering Project Management					
9% of Design and Construction Management Services					$12,197.79
Subtotal Estimated Costs (w/contractor overhead and profit):					$244,037
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$12,202
Subtotal Estimated Costs (w/legal and administrative costs):					$256,239
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$51,248
Total Preliminary Estimated Capital Costs of Remedial Alternatives:					**$307,486**
Annual Costs					
Perform topographic survey to monitor settling every 5 years	day	1	$161.00	$161.00	
Conduct 5 year review of remedy performance	ls		$5,850.00	$5,850.00	
Repair damage to cover	ls		$4,212.00	$4,212.00	
Annualized costs ($10,223) over 30 years assume discount rate of 3.1%				$10,223.00	$197,810.00
Subtotal Estimated Costs (w/contractor overhead and profit):					$197,810
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$9,891
Subtotal Estimated Costs (w/legal and administrative costs):					$207,701
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$41,540
Total Preliminary Estimated Annual Costs of Remedial Alternatives:					**$249,241**
Total Preliminary Estimated Costs of Remedial Alternatives:					**$556,727**

Notes

1. Totals may not sum exactly because of rounding.
2. Field effort for cap construction is estimated for 1 week in duration.
3. Costs for groundwater monitoring are included in the Groundwater RU Costs.
4. Derivation of unit rates is presented in Table F-6.

Table F-4b
Telecommunications Corridor Remedial Unit
Estimated Costs Associated with Soil Excavation and Offside Disposal
Building 1349 Study Area
Presidio of San Francisco, California

	Estimated Costs				
Task Description	**Unit**	**Quantity**	**Unit Cost**	**Subtotal**	**Total**
Capital Costs					
General Site Preparation					
Mobilize Contractor Equipment and Supplies to Site	ls	1	$23,400	$23,400	
Erect and Maintain Perimeter Temporary Fence	ft	1000	$12.00	$12,000	
Decontamination Area for Personnel and Equipment	ls	1	$1,500	$1,500	
					$36,900
Excavate Waste and Soil					
Reroute Telecommunications Conduit	ls	1	$60,000	$60,000	
Excavate Soil, No Segregation	cy	380	$4.10	$1,558	
Collect Soil Profile Samples for Disposal (every 500 cy)	ea	2	$30	$61	
Disposal Characterization					
PAHs by USEPA Method 8081/8082	ea	2	$250	$500	
Total Petroleum Hydrocarbons as Diesel Fuel, Fuel Oil, and Gasoline (USEPA 8015M + USEPA 3630A, silica gel cleanup)	ea	2	$140	$280	
OCPs (USEPA 8081)	ea	2	$165	$330	
Backfill Exavation	cy	494	$23.00	$11,362	
Dispose of Nonhazardous Soil at Class II Facility	ton	790	$35	$27,664	
Replant in Historic Forest Zone	acre	0.03	$58,000	$1,740	
					$103,495
Abandon Well 1349MW100					
Abandon 2-inch PVC Monitoring Wells	ea	1	$1,755	$1,755	
Dispose of Well Abandonment Residuals	ea	1	$500	$500	
Install Replacement Well 1349MW100R					
Mobilize contractor equipment and supplies to site	ls	1	$300	$300	
Drill and install groundwater monitoring well	ft	45	$38	$1,710	
Engineer to install the groundwater well	day	1	$1,170	$1,170	
Conduct Groundwater Monitoring (replacement well)					
Sample Well	ea	1	$263	$263	
Dispose of Groundwater Sampling Residuals	event	1	$500	$500	
Analyze Groundwater Samples from Wells					
General Water Quality Parameters	ea	1	$205	$205	
Volatile Organic Compounds (USEPA Method 8260B)	ea	1	$250	$250	
Polycyclic Aromatic Hydrocarbons (USEPA Method 8270C)	ea	1	$250	$250	
Organochlorine Pesticides (USEPA Method 8081)	ea	1	$165	$165	
Total Petroleum Hydrocarbons as Gasoline, as Diesel Fuel, and as Motor Oil (USEPA 8015 + USEPA 3630A, silica gel cleanup)	ea	1	$140	$140	
Metals (USEPA Method 6010/7000)	ea	1	$225	$225	
Perform Independent Data Validation	ea	1	$41	$41	
Input Analytical Results into Presidio Database	ea	1	$18	$18	
					$7,492
Design and Construction Management Services					
Engineering					
Perform General Planning Activities	ls	1	$23,400	$23,400	
Prepare Remedial Design (plans and specifications)	sheet	6	$7,500	$45,000	
Bid, Award, and Negotiate Construction Contract	ls	1	$29,250	$29,250	
					$97,650
Design and Construction Management Services for Well abandonment					
Engineering/Project Management/Office Support	day	1	$500	$500	
Construction Observation and Coordination	day	1	$1,000	$1,000	
Prepare Well Abandonment Letter Report	ls	1	$5,000	$5,000	
					$6,500

Table F-4b
Telecommunications Corridor Remedial Unit
Estimated Costs Associated with Soil Excavation and Offside Disposal
Building 1349 Study Area
Presidio of San Francisco, California

Construction Observation					
Provide Resident Engineer	wk	2	$5,850	$11,700	
Provide Office Support	wk	2	$2,340	$4,680	
Provide Vehicles and Equipment	wk	2	$1,521	$3,042	
Perform Air Monitoring	wk	2	$1,170	$2,340	
Collect Soil Confirmation Samples	ea	26	$30	$780	
PAHs by USEPA Method 8081/8082	ea	26	$250	$6,500	
Total Petroleum Hydrocarbons as Diesel Fuel, Fuel Oil, and Gasoline (USEPA 8015M + USEPA 3630A, silica gel cleanup)	ea	26	$140	$3,640	
OCPs (USEPA 8081)	ea	26	$165	$4,290	
Perform Independent Data Validation	ea	26	$41	$1,066	
Input Analytical Results into Presidio Database	ea	26	$18	$468	
Prepare Remediation Completion Report	ls	1	$27,000	$27,000	
					$65,506
Engineering Project Management					
9% of Design and Excavation Management Services	ls	9%			$15,269.04
Subtotal Estimated Costs (w/contractor overhead and profit):					$332,812
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$16,641
Subtotal Estimated Costs (w/legal and administrative costs):					$349,452
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$69,890
Total Preliminary Estimated Capital Costs of Remedial Alternatives:					**$419,343**

Notes and Assumptions:

1. Totals may not sum exactly because of rounding.
2. Field effort of excavation and well abandonment is estimated to be 2 weeks in duration.
3. Sidewall confirmation samples will be collected at an approximate frequency of one sample per every 50 linear feet for a total of 5 samples (plus 1 duplicate). Samples will be analyzed for TPHd, TPHfo, TPHg, (USEPA 8015M),PAHs (USEPA 8270), and OCPs (USEPA8081). All samples for TPH analysis will be prepared with a silica gel cleanup (SGCU).
4. Bottom confirmation samples will be collected at a frequency of one sample per 625 sf for a total of 2 samples. Samples will be analyzed for the same parameters as sidewall samples.
5. Waste characterization samples will be collected approximately one per 500 cy. Samples will be analyzed for TPH and PAHs.
6. Costs based on assumption that soils will be excavated to a minimum of 16 feet bgs. Attempts will be made to excavate deeper to address soil impacts at greater depths and above groundwater. Costs for additional excavation and disposal are expected to be minimal and within the order of magnitude of costs presented.
7. Volumes are provided in Table 5-1.
8. Conversion factor from cy of soil to tons is 1.6.
9. Soil volume is in-situ estimation. Backfill is estiated as 1.3 compaction factor.
10. As noted in text, groundwater sampling will be conducted before abandondment and after installation of well 1349MW100.
To be cost efficient, quarterly monitoring event will be scheduled to coordinate with abandonment avtivites.
11. Derivation of the unit rates is presented in Table F-6.

Table F-5a
Groundwater Remedial Unit
Estimated Costs Associated with No Action
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Estimated Costs				
	Unit	**Quantity**	**Unit Cost**	**Subtotal**	**Total**
Capital Costs					
Abandon Wells					
Abandon Groundwater Monitoring well (9 wells)					
Abandon 2-inch PVC Monitoring Wells	ea	9	$1,755	$15,795	
Dispose of Well Abandonment Residuals	ea	9	$500	$4,500	
					$20,295
Design and Construction Management Services					
Engineering/Project Management/Office Support	day	3	$500	$1,500	
Construction Observation and Coordination	day	3	$1,000	$3,000	
Prepare Well Abandonment Letter Report	ls	1	$5,000	$5,000	
					$9,500
Subtotal Estimated Costs (w/contractor overhead and profit):					$29,795
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$1,490
Subtotal Estimated Costs (w/legal and administrative costs):					$31,285
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$6,257
Total Preliminary Estimated Capital Costs of Remedial Alternative:					**$37,542**

Notes
1. Totals may not sum exactly because of rounding.
2. Derivation of unit rates is presented in Table F-6.

Table F-5b
Groundwater Remedial Unit
Estimated Costs Associated with Groundwater Monitoring
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Unit	Quantity	Unit Cost	Subtotal	Total
	Estimated Costs				
Capital Costs					
Installation of two groundwater monitoring wells					
Mobilize contractor equipment and supplies to site	day	2	$300	$600	
Drill and install groundwater monitoring well	ft	90	$38	$3,420	
Engineer to install the groundwater well	day	2	$1,170	$2,340	
					$6,360
Abandon Wells at the Completion of Groundwater Monitoring					
Abandon Groundwater Monitoring well (11 wells)					
Abandon 2-inch PVC Monitoring Wells	ea	11	$1,755	$19,305	
Dispose of Well Abandonment Residuals	ea	11	$500	$5,500	
					$24,805
Design and Construction Management Services					
Engineering/Project Management/Office Support	day	4	$500	$2,000	
Construction Observation and Coordination	day	4	$1,000	$4,000	
Prepare Well Abandonment Letter Report	ls	1	$5,000	$5,000	
					$11,000
Prepare 5 year Status Report per RWQCB Order	ls	1	$10,000.00	$10,000.00	
					$10,000
Subtotal Estimated Costs (w/contractor overhead and profit):					$52,165
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$2,608
Subtotal Estimated Costs (w/legal and administrative costs):					$54,773
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$10,955
Total Preliminary Estimated Capital Costs of Remedial Alternative:					**$65,728**
Annual Costs					
Groundwater Remedial Unit[1]					
Conduct Groundwater Monitoring (9 existing wells + 2 new wells)					
Sample Wells (11 wells and 1 duplicate sample per event)	ea	48	$263	$12,624	
Dispose of Groundwater Sampling Residuals	event	4	$500	$2,000	
Analyze Groundwater Samples from Wells					
General Water Quality Parameters	ea	48	$205	$9,840	
Volatile Organic Compounds (USEPA Method 8260B)	ea	48	$250	$12,000	
Polycyclic Aromatic Hydrocarbons (USEPA Method 8270C)	ea	48	$250	$12,000	
Organochlorine Pesticides (USEPA Method 8081)	ea	48	$165	$7,920	
Total Petroleum Hydrocarbons as Gasoline, as Diesel Fuel, and as Motor Oil (USEPA 8015 + USEPA 3630A, silica gel cleanup)	ea	48	$140	$6,720	
Metals (USEPA Method 6010/7000)	ea	48	$225	$10,800	
Perform Independent Data Validation	ea	48	$41	$1,968	
Input Analytical Results into Presidio Database	ea	48	$18	$864	
Prepare Semi-Annual Monitoring Reports	ls	2	$5,850	$11,700	
			Annual Cost	$88,436	
Groundwater Monitoring Costs Annualized over 5 years, assume discount rate of 3.1%					$403,857
Subtotal Estimated Costs (w/contractor overhead and profit):					$403,857
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$20,193
Subtotal Estimated Costs (w/legal and administrative costs):					$424,050
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$84,810
Total Preliminary Estimated Annual Costs of Remedial Alternative:					**$508,860**
Total Preliminary Estimated Costs of Remedial Alternative:					**$574,588**

[1] - Groundwater RU will sample all existing monitoring wells and the two newly-installed monitoring wells.
This includes the groundwater monitoring necessary for Shallow Soil RU, Deep Soil RU, and Telecommunications RU.

Notes
1. Totals may not sum exactly because of rounding.
2. Assumes 5 year costs based on quarterly sampling as a conservative estimate. Monitoring data will be reviewed after the initial 2 year period. Sampling frequenc for some or all wells may be reduced resulting in lower costs.
3. Assumes two days to install new wells and four days to abandon wells.
4. Costs for groundwater monitoring are included in the Groundwater RU Costs.
5. Derivation of unit rates is presented in Table F-6.

Table F-5c
Groundwater Remedial Unit
Estimated Costs Associated with Land-Use Controls
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Estimated Costs Unit	Quantity	Unit Cost	Subtotal	Total
Capital Costs					
Allocated share to prepare LUC Master Reference Report	ls	1	$2,500.00	$2,500.00	
Prepare Site-Specific Addendum to the Land-Use Control					
Master Reference Report (Area B)	ls	1	$5,000.00	$5,000	
Add Site-Specific Land-Use Controls to Trust GIS System	ls	1	$585.00	$585	
					$8,085
Subtotal Estimated Costs (w/contractor overhead and profit):					$8,085
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					$404
Subtotal Estimated Costs (w/legal and administrative costs):					$8,489
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$1,698
Total Preliminary Estimated Capital Costs of Remedial Alternatives:					**$10,187**
Annual Costs					
Project Management/Administration					
Annual Administrative Cost of Land-Use Controls (Area B)	ls	30	$1,000.00	$1,000	
Five-Year Review (annualized $2,000 over 30 years)	ls	30	$2,000.00	$2,000	
Annual costs annualized over 30 years, assumes discount rate of 3.1%					$58,048
Subtotal Estimated Costs (w/contractor overhead and profit):					$58,048
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):					-
Subtotal Estimated Costs (w/legal and administrative costs):					$58,048
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):					$11,610
Total Preliminary Estimated Annual Costs of Remedial Alternatives:					**$69,658**
Total Preliminary Estimated Costs of Remedial Alternatives:					**$79,845**

Notes

1. Totals may not sum exactly because of rounding.
2. Derivation of unit rates is presented in Table F-6.

Table F-6
Derivation of Unit Rates
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Unit	Unit Cost 2000 dollars	Unit Cost 2005 dollars	Source
CAPITAL COSTS				
General Site Preparation				
Mobilize contractor equipment and supplies to site	ls	$20,000	$23,400	Table E-3, Main Installation Sites FS, Erler & Kalinowski, Inc, March 2003 (EKI).
Mobilize contractor equipment and supplies to misc. site	ls	$1,000	$1,170	EKI, assumes backhoe for excavation < 1,000 cy.
Erect and maintain perimeter temporary fence	ft	$10.00	$12	EKI
Provide Personnel Protective Equipment (PPE)	ls		$2,000	Blasland, Bouck and Lee (BBL)
Decontamination area for personnel and equipment	ls		$1,500	BBL
Excavate Waste and Soil				
Excavate soil no segregation	cu	$3.50	$4.10	EKI, assumes 3 yard bucket, cost may increase with smaller volumes
Collect soil profile samples for disposal	ea	$26	$30.42	EKI
Disposal characterization				
Total Petroleum Hydrocarbons as Gasoline, as Diesel Fuel, and as Motor Oil (EPA 8015M + EPA 3630A, silica gel cleanup)	ea		$140	Curtis & Tompkins (C&T)
Polycyclic Aromatic Hydrocarbons (EPA Method 8270)	ea		$250	C&T
Backfill Excavation	cy	$20	$23	EKI, import, place and compact
Dispose of non-hazardous soil at Class II facility	ton	$35	$41	Presidio Trust (Trust)
Import and place 1 foot topsoil layer	cy	$30	$35	EKI
Restoration Activities				
Replant in Historic Forest Zone	acre		$58,000	Trust
Hydroseed	acre	$1,200	$1,404	EKI
Abandon Existing Groundwater Monitoring Wells				
Abandon 2-inch PVC monitoring wells	ea	$1,500	$1,755	EKI
Dispose of well abandonment residuals	ea		$500	BBL Subcontractor
Capping				
General Site Preparation				
Erect and maintain perimeter temporary fencing	ft	$10.00	$12	EKI
Decontamination area for personnel and equipment	ls		$1,500	BBL
Construct Cap				
Mobilize contractor equipment and supplies to site	ls	$5,000	$5,850	EKI
Furnish and install geosynthentic liner	sf	$0.65	$1	EKI, $1500 minimum (BBL)
Import and Place Clean Topsoil (12 inches)	cy	$30	$35	EKI
Installation of one groundwater monitoring well				
Mobilize contractor equipment and supplies to site	day		$300	BBL subcontractor
Drill and install groundwater monitoring well	ft		$38	BBL subcontractor
Engineer to install the groundwater well	day	$1,000	$1,170	EKI
Implement Land Use Controls				
Allocated share to prepare Presidio LUC Master Reference Report	ls		$2,500.00	Trust
Prepare Site-Specific Addendum to LUCMRR	ls		$5,000	Trust
Add Site-Specific Land Use Controls to Trust GIS System	ls	$500	$585	EKI
Design and Construction Management Services				
Engineering				
Engineering/Project Management/Office Support	day		$500.00	BBL, assumes engineer 1/2 day in office
Construction Observation and Coordination	day		$1,000.00	BBL
Prepare Well Abandonment Letter Report	ls		$5,000.00	BBL
Perform general planning activities	ls	$20,000	$23,400	EKI
Prepare Remedial Design (plans and specifications)	ls	$75,000	$87,750	EKI
Prepare Remedial Design (plans and specifications)	sheet	$7,500	$8,775	EKI
Bid, award, and negotiate construction contract	ls	$25,000	$29,250	EKI
General Administrative Costs	ls		$5,000	BBL
Construction Observation				
Provide resident engineer	wk	$5,000	$5,850	EKI assumes $100/hour, 10 hr/day, 5 days/wk
Provide office support	wk	$2,000	$2,340	EKI, assumes $100/hour, 4 hr/day, 5 days/wk
Provide vehicles and equipment (including PPE)	wk	$1,300	$1,521	EKI, assumes vehicle, field supplies, photographs, OVM, Health and Safety Equipment
Perform air monitoring	wk	$1,000	$1,170	EKI

Table F-6
Derivation of Unit Rates
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Unit	Unit Cost 2000 dollars	Unit Cost 2005 dollars	Source
Confirmation Soil Sampling				
Collect soil confirmation samples, surface	ea	$26	$30	EKI
Total Petroleum Hydrocarbons as Gasoline, as Diesel Fuel, and as Motor Oil (EPA 8015M + EPA 3630A, silica gel cleanup)	ea		$140	C&T
Polycyclic aromatic hydrocarbons (EPA Method 8270)	ea		$250	C&T
Prepare Remediation Completion report	ls		$27,000	BBL
Engineering Project Management				
9% of Design and Excavation	ls	9%		EKI
ANNUAL COSTS				
Conduct Groundwater Monitoring				
Sample wells	ea	$225	$263	EKI
Dispose of groundwater sampling residuals	ls		$500	BBL Subcontractor
Analyze groundwater samples from wells				
General Water Quality Parameters	ea	$175	$205	C&T
Metals (EPA Method 6010/7000 Series)	ea		$225	C&T
Volatile Organic Compounds (EPA Method 8260B)	ea		$250	C&T
Polycyclic Aromatic Hydrocarbons (EPA Method 8270)	ea		$250	C&T
Organochlorine Pesticides (EPA Method 8081)	ea		$165	C&T
Total Petroleum Hydrocarbons as Gasoline, as Diesel Fuel, and as Motor Oil (EPA 8015M + EPA 3630A, silica gel cleanup)	ea		$140	C&T
Perform independent data validation	ea	$35	$41	EKI
Input analytical results into Presidio database	ea	$15	$18	EKI
Prepare Semi-Annual Monitoring Reports	ea	$5,000	$5,850	EKI (assume letter-report)
Project Management /Administration				
Annual administrative cost of Land Use Controls	ls	$1,000	$1,170	EKI
Annualized cost of Five-Year Review (6 occurrences)	ls	$2,000	$2,340	Trust
Land-Use Controls (30 years)				
Annual Cost for Trust administration	year		$1,000	Trust
5-year Review (annualized $2,000/year)	year		$2,000	Trust
Capping				
Perform topographic survey to monitor settling every 5 years	day		$161.00	BBL, assumes $800/day, annual cost at $161
Conduct 5 year review of remedy performance	ls	$5,000.00	$5,850.00	EKI, assumes $25,000 to prepare report, annual cost of $5,000
Repair damage to cover	ls	$3,600.00	$4,212.00	

Notes:

Costs were originally developed in July 2000 primarily from estimates and quotations provided by .
contractors and vendors and EKI's project team's experience on similar projects in the Bay Area.
These costs were provided in the 2003 Feasibility Study for the Main Installation Sites
Unit rates from the FS are show in 2000 dollars and have been updated to current dollars using cost index
factors calculated in the Engineer News Record (ENR). The ENR update factor (117% for July 2000 to February 2005)
was applied to the unit rates in order to use them with other 2005 unit rates to prepare cost estimates.
Additional Costs provided in 2005 dollars by BBL and BBL subcontractors.

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Table F-7
All Soil Remedial Units
Estimated Costs Associated with Implementation of Preferred Alternatives
Building 1349 Study Area
Presidio of San Francisco, California

Task Description	Estimated Costs				
	Unit	Quantity	Unit Cost	Subtotal	Total
Capital Costs					
Shallow Soil RU, Deep Soil RU, Telecommunications RU-Excavation and Offsite Disposal					
General Site Preparation					
Mobilize Contractor Equipment and Supplies to Site	ls	1	$23,400	$23,400	
Erect and Maintain Perimeter Temporary Fence	ft	1000	$12.00	$12,000	
Decontamination area for personel and equipment	ls	1	$1,500	$1,500	
					$36,900
Abandon Well 1349MW103 and 1349MW100					
Abandon 2-inch PVC Monitoring Wells	ea	2	$1,755	$3,510	
Dispose of Well Abandonment Residuals	ea	2	$500	$1,000	
Install Replacement Well 1349MW103R and 1349MW100R					
Mobilize contractor equipment and supplies to site	ls	1	$300	$300	
Drill and install groundwater monitoring well	ft	90	$38	$3,420	
Engineer to install the groundwater well	day	2	$1,170	$2,340	
Conduct Groundwater Monitoring (replacement well)					
Sample Well	ea	2	$263	$526	
Dispose of Groundwater Sampling Residuals	event	1	$500	$500	
Analyze Groundwater Samples from Wells					
General Water Quality Parameters	ea	2	$205	$410	
Volatile Organic Compounds (USEPA Method 8260B)	ea	2	$250	$500	
Polycyclic Aromatic Hydrocarbons (USEPA Method 8270C)	ea	2	$250	$500	
Organochlorine Pesticides (USEPA Method 8081)	ea	2	$165	$330	
Total Petroleum Hydrocarbons as Gasoline, as Diesel Fuel, and as Motor Oil (USEPA 8015 + USEPA 3630A, silica gel cleanup)	ea	2	$140	$280	
Metals (USEPA Method 6010/7000)	ea	2	$225	$450	
Perform Independent Data Validation	ea	2	$41	$82	
Input Analytical Results into Presidio Database	ea	2	$18	$36	
					$14,184
Excavate Waste and Soil					
Reroute Telecommunications Condiut	ls	1	$60,000	$60,000	
Excavate Soil, No Segregation	cy	1190	$4.10	$4,879	
Collect Soil Profile Samples for Disposal (every 500 cy)	ea	5	$30	$152	
Disposal Characterization					
PAHs by USEPA Method 8081/8082	ea	5	$250	$1,250	
Total Petroleum Hydrocarbons as Diesel Fuel, Fuel Oil, and	ea	5	$140	$700	
Backfill Exavation	cy	1547	$23.00	$35,581	
Dispose of Nonhazardous Soil at Class II Facility	ton	2475	$35	$86,632	
					$189,194
Restoration Activities					
Replant in Historic Forest Zone	acre	0.13	$58,000	$7,540	
					$7,540
Design and Construction Management Services					
Engineering					
Perform General Planning Activities	ls	1	$23,400	$23,400	
Prepare Well Abandonment Letter Report	ls	1	$5,000	$5,000	
Prepare Remedial Design (plans and specifications)	ls	1	$75,000	$75,000	
Bid, Award, and Negotiate Construction Contract	ls	1	$29,250	$29,250	
					$132,650

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Table F-7
All Soil Remedial Units
Estimated Costs Associated with Implementation of Preferred Alternatives
Building 1349 Study Area
Presidio of San Francisco, California

Construction Observation						
	Provide Resident Engineer	wk	5	$5,850	$29,250	
	Provide Office Support	wk	5	$2,340	$11,700	
	Provide Vehicles and Equipment	wk	5	$1,521	$7,605	
	Perform Air Monitoring	wk	5	$1,170	$5,850	
	Collect Soil Confirmation Samples	ea	62	$30	$1,860	
	PAHs by USEPA Method 8081/8082	ea	62	$250	$15,500	
	Total Petroleum Hydrocarbons as Diesel Fuel, Fuel Oil, and	ea	62	$140	$8,680	
	OCPs (USEPA 8081)	ea	35	$165	$5,775	
	Perform Independent Data Validation	ea	62	$41	$2,542	
	Input Analytical Results into Presidio Database	ea	62	$18	$1,116	
	Prepare Remediation Completion Report	ls	1	$27,000	$27,000	
						$116,878
Engineering Project Management						
	9% of Design and Excavation Management Services	ls	9%			$22,457.52
Subtotal Estimated Costs (w/contractor overhead and profit):						$519,804
Legal and Administrative Costs (assumed to be 5 percent of subtotal estimated costs w/contractor overhead and profit):						$25,990
Subtotal Estimated Costs (w/legal and administrative costs):						$545,794
Contingencies (assumed to be 20 percent of subtotal estimated costs w/legal and administrative costs):						$109,159
Total Preliminary Estimated Capital Costs of Remedial Alternatives:						**$654,953**

Notes:
1. Totals may not sum exactly because of rounding.
2. Derivation of unit rates is presented in Table F-6.
3. Assumptions for excavation and offsite disposal in each RU are detailed on Tables F-2b, F-3a, and F-4b

Appendix G

Hydrogeochemistry Data

Figure G-1 - Piper Plots of Cation/Anion Concentrations

Building 1349 Study Area Wells - March 2004 Data

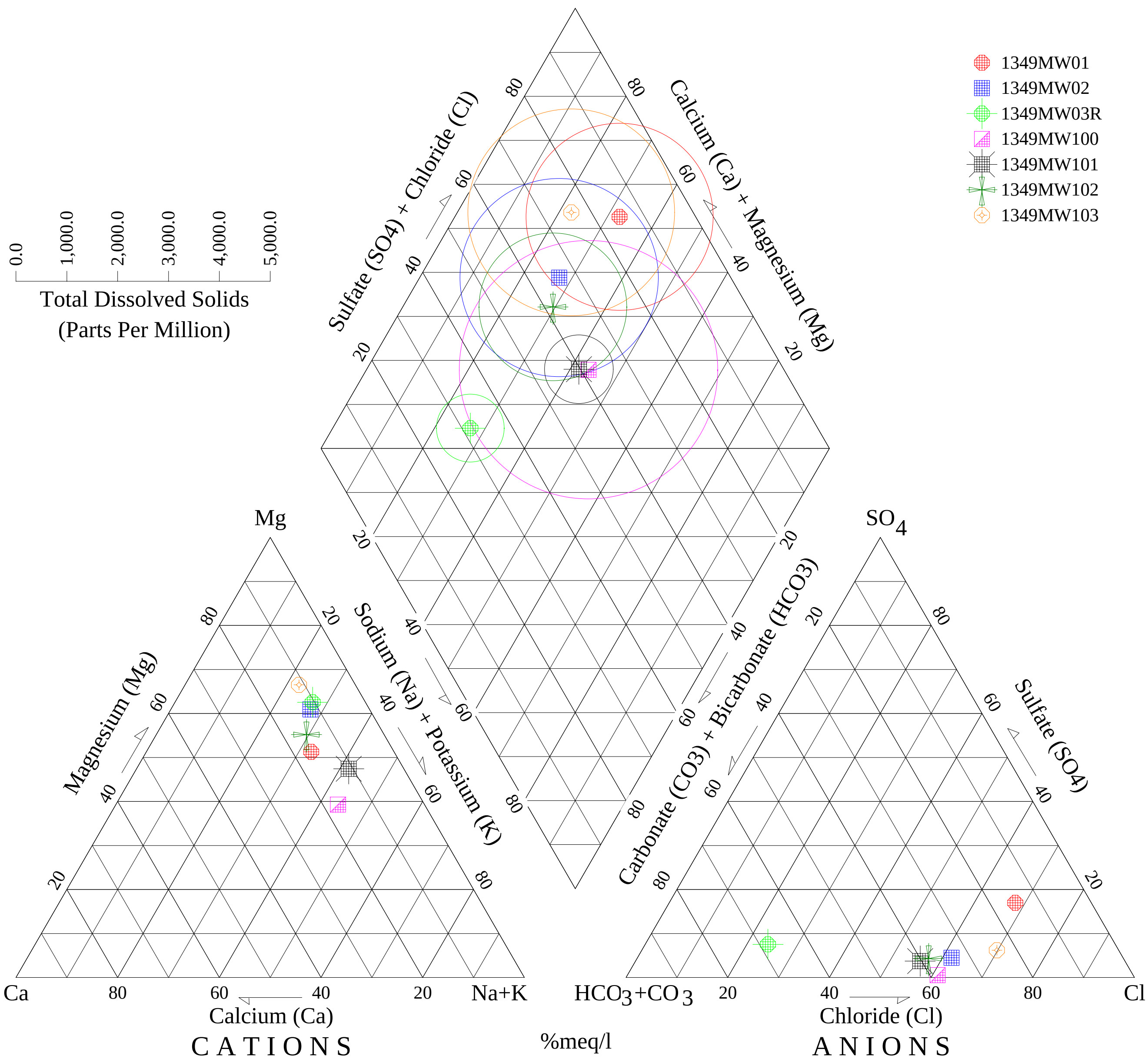

Figure G-2 - Piper Plots of Cation/Anion Concentrations

Building 1349 Study Area Wells - March 2004 Data